FEBRUARY 20, 1957

electronics

business edition

A McGRAW-HILL PUBLICATION · VOL. 30, NO. 28 · PRICE FIFTY CENTS

NEWS AT A GLANCE

BIG INDUSTRIAL CONTROL MARKET SHAPES UP . . . . .

. . . Industry bets $500 million on atomic power (page 13) . . . Magnetic amplifiers challenge tubes and transistors (page 15) . . . On-the-job training adds more manpower mileage (page 17) . . . Low-temperature physics creates new computer memory device (page 19) . . . Small computers take increasing share of data-processing market (page 20) . . . Technical-manual writers reveal project-estimating yardsticks (page 29) . . . Tv broadcasters boom translators and satellites (page 39) . . . New team takes over at RCA (page 46) . . .

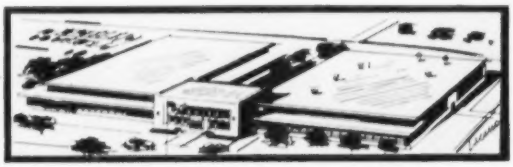
BURNS of RCA: "I like the excitement of industry."

E B POWER GS L-
UNIVERSITY MICROFILMS IN
313 N 1 ST
ANN ARBOR MICH ☆ C

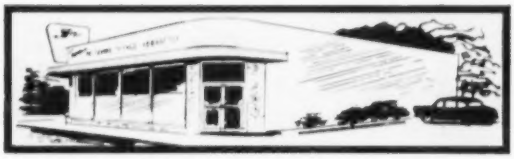
From the idea . . .

. . . to automated mass production

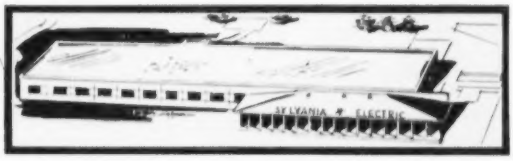
Headquarters for the Division, the Waltham Laboratories, in Waltham, Massachusetts, specialize in advanced systems related to guided missiles, avionics, radar, data processing and electronic warfare.



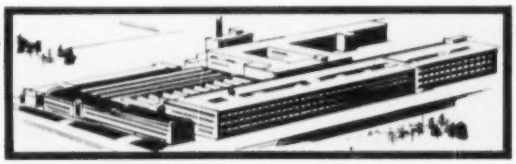
The Electronic Defense Laboratory, Mountain View, California, is a special development facility devoted to research, technical development and rapid fabrication of ground-based electronic warfare systems.



The Microwave Physics Laboratory, at Mountain View, California, is devoted to the investigation of new magnetic materials and ionized gaseous media for microwave control devices used in radar, communications and electronic countermeasures systems.



The Microwave Tube Laboratory, Mountain View, California, is engaged in developing and producing special tubes such as klystrons, traveling wave tubes, backward wave oscillators, and related devices.



Buffalo Engineering Laboratory and manufacturing facilities for the Division occupy some 170,000 square feet of floor space in this industrial center. The Laboratory specializes in the development of advanced communications techniques and equipments.

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business edition

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FEBRUARY 20, 1957

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Industry Outlook

STUDENTS OF POPULATION tell us the U.S. working force is increasing at the rate of about one percent a year while the number of dependents is increasing 1.7 percent a year. Problem for industry as a whole: Produce more with fewer workers. Electronic equipment can do much to fill the breach:

- **In education, closed-circuit classroom television can take the place of an estimated 50,000 teachers now unavailable.**

- **Automatic digital computers for handling business data can relieve an army of clerks for more creative work. Could increase present $100-million digital computer market 20-fold or more.**

- **Digitally programmed machine tools can make up for the critical shortage of skilled tool-and-die makers. Possible market: in excess of $¼ billion.**

- **Chemical and petroleum processing industries can become almost fully automatic. Central computers can correct processes anywhere in the plant.**

Industrial electronics may easily become our industry's major market, intimately linked to steadily rising capital expenditures of industry at large. With expansion of industrial electronics will come need for even more electronic engineers and technicians. For engineers already in electronics will come opportunities to apply, to industrial control devices, lessons in reliable, rugged design learned building equipment for the armed forces.

▼

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"GEIGER COUNTER for $98.50 caused buying rushes and regular use of Air Express," says the President of The Detectron Corp., J. L. Cassingham.

"GUIDED MISSILE PARTS always meet military schedules – thanks to Air Express," says Vincent Sillitta, Traffic Manager, Clarostat Mfg. Co., Inc.

"THUNDERBIRD preview color prints get delivered on time by Air Express," says Joseph H. Snyder, President, Color Corp. of America.

"BUYING RUSHES on top-fashion bathing suits are always met by sure Air Express delivery," says Board Chairman of Catalina, Inc., A. Louis Oresman.

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"MILLION DOLLAR MENU, possible because Air Express carries our Chinese food samples nationwide," says Jeno Paulucci, President of Chun King Sales, Inc.

"TOURNAMENT CLUBS arrive on time anywhere in the U. S. A. when sent Air Express," says Henry P. Cowen, President, MacGregor Golf Co.

"WE STOP BURGLARS, shipping parts for our alarm systems Air Express," says J. B. Rustic, General Superintendent, American District Telegraph Co.

radio-equipped trucks for pick-up and delivery — cutting time by more than *half* in many markets.

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1 cps to 1 MC Square Wave Generator with 0.02 μsec rise time

Other Unusual Features

7 volt 75 ohm TV circuit
55 volt 600 ohm high level circuit
Full amplitude variation
External synchronization

The new *-hp-* 211A Square Wave Generator permits fast measurement of audio and video amplifier frequency phase and transient characteristics up to several megacycles. In computer, pulse code and telemetering work, it materially simplifies triggering and switching. It is excellent for testing television circuitry, and ideal for modulating high frequency circuits, testing attenuators, filters and delay lines. In general laboratory use it is an excellent means of measuring time constants, indicating phase shift, frequency response and transient response.

Model 211A has many unique features. Besides the 0.02 μsec rise time and two separate outputs (with full amplitude variation on both), the generator can be operated either free-running or externally synchronized. External synchronizing can be either with a positive going pulse or a sine wave signal of 5 volts amplitude. Much of the instrument's circuitry is etched to provide clean, trouble-free layout, compact size, freedom from stray capacity variations, and thus, a highly uniform product. The generator is of quality construction throughout and is housed in a streamlined, lightweight metal cabinet.

SPECIFICATIONS

Frequency Range: 1 cps to 1 MC, continuous coverage.

Low Impedance Output: 7.0 v peak-to-peak across 75 ohm internal impedance. Rise time less than 0.02 μsec. BNC Connector.

High Impedance Output: 55 v peak-to-peak across 600 ohm internal impedance. Rise time less than 0.1 μsec. Dual banana jacks — ¾" centers.

Amplitude Control: Low Impedance Output — Potentiometer and 60 db attenuator, variable in 20 db steps. High Impedance Output—Potentiometer.

Frequency Control: Dial calibrated "1 to 10" and decade multiplier switch. Six bands.

Symmetry Control: Allows exact square-wave balance.

Sync Input: Positive-going pulse or sine wave signal, minimum amplitude 5 volts peak. BNC connector.

Power: 115/230 v +10%, 50/60 cps, 195 watts.

Size: 9¾" wide, 13⅞" high, 13⅜" deep.

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TAX help on upswing

Fast writeoffs still okayed
But only defense plants qualify
Help now totals $700 million

GOVERNMENT tax help for electronics manufacturers is still available, despite the administration's turndown of demands for accelerated amortization from many other industries.

Since the current ground rules for fast tax writeoffs were set in 1954, electronics manufacturers have obtained tax help on over $300 million worth of new electronics plants and facilities. Since the Korean conflict the industry has gotten tax help on more than $700 million worth.

Approvals on fast writeoff requests are on the upswing today, with over $7 million worth of expansion okayed in December.

Some of the recent projects approved for rapid amortization include: IBM's $9,276,000 guided-missile systems plant at Owego, N. Y., 45 percent of which will get the five-year writeoff; Varian's $4,700,000 electronic equipment plant at Palo Alto, Calif., 50 percent.

Also Sperry Rand's $1,200,000 electronic equipment plant at Charlottesville, Va., 40 percent; Burroughs' $1,105,000 Detroit electronic computer facility, 40 percent; Gulton's $1,108,260 equipment plant at Metuchen, N. J., 60 percent; and Western Electric's four North Carolina electronic equipment installations, costing $246,403, of which 65 percent will be eligible for fast writeoff.

Small PROJECTS get nod

RECENT approvals include many smaller projects. Collins got 65 percent of its $41,666 aircraft equipment facility at Cedar Rapids, Iowa approved for fast amortization; Tydeman Machine Works got an OK

SHARES and PRICES

TV SET MANUFACTURING is currently the softest division of the electronics industry. Prices of most shares are well below 1956 highs; some as much as 50 percent.

The industry's dollar sales and profits dropped severely in 1956. Seven of the 11 firms shown in the table earned less last year than in the same period in 1955. Several reduced cash dividends. Six companies got out of tv manufacturing.

Nevertheless, other companies overcame the general industry trend. Magnavox, Packard-Bell and Unitronics (formerly Olympic) reported sales increases.

Little improvement in the tv industry pattern is expected in 1957. However, the future holds some bright spots.

Many market experts feel that attractive long-run prospects make tv shares worth holding. One big hope for the future is the eventual development of a mass market for color sets.

Television Set Manufacturers	Recent Price	1956 Dividends	Yield Percent	Earned Per Share 1956	Earned Per Share 1955	Traded	1956 Price Range
Admiral	14⅛	1.00	7.1	0.76(9 mo)	3.64	NYSE	12⅞–22⅛
DuMont Laboratories	5	0.00		d-0.43(9 mo)	d-1.61	ASE	4⅜–10
Emerson Radio & Phono	6¾	0.30 [1]	4.4	0.02(39 wk)	0.82	NYSE	5¾–13¼
Hoffman Electronics	20	0.75	3.8	1.51(9 mo)	2.15	PCSE	18⅜–25⅛
Magnavox	36	1.50 [1]	4.2	3.54(yr)	3.05	NYSE	31½–41
Motorola	37⅛	1.50	3.9	2.49(9 mo)	4.39	NYSE	37½–51¾
Packard-Bell Electronics	9⅜	0.50	5.3	1.25(yr)	0.93	OTC	8⅜–10⅜
Philco	17½	0.80 [1]	4.6	0.21(9 mo)	2.13	NYSE	16 –36½
RCA	34	1.50	4.4	1.82(9 mo)	3.16	NYSE	33⅞–50⅜
Unitronics	8⅛	0.00 [2]	...	0.69(yr)	1.05	ASE	6⅜–10
Zenith Radio	97	5.00	5.2	7.90(9 mo)	16.31	NYSE	101 –141¼

[1] plus stock dividend [2] paid 0.05 cash plus stock Feb. 7, 1957 d-deficit

on 70 percent of $38,762 for new facilities at Redwood City, Calif.; Cambridge Thermionic got 70 percent on a $4,719 outlay at Cambridge, Mass.

To get fast tax writeoff help from the government on new plant or equipment:

- The manufacturer must devote the entire output of his new facility to the military.
- He must convince the Office of Defense Mobilization that his added output of an item will ease a serious shortage in the overall market supply available to the military.

There is no longer a production capacity expansion goal for the electronics industry as such. This was closed down in 1954. Since then, an electronics company must be engaged either in defense production or research and development to qualify.

Most of the application approvals are going for end products like missile systems, computers and radar. Fewer tax writeoff certificates are being okayed to expand production of receiving tubes, resistors, transistors, capacitors and the like.

EB&S seeks growth

Electric Bond & Share, former utility holding company giant, has decided, after a year of study, that the field of electronic automation is one of three areas which currently offer the greatest growth potential. The other two are petrochemicals and glass fiber. The study was made as part of the holding company's plans to become a fixed investment trust.

Ultimately some $50,000,000 obtained from sale of the company's domestic holdings will be invested in these three industries. It already has invested about $1.5 million in Litton Industries, Ampex and Applied Science of Princeton. By 1958 it expects to have $5 million invested with electronics companies.

Its electronic automation investment program calls for investments in: components, tape recorders, data processing, missiles, industrial controls, radiation and spectrophotographic equipment and test equipment.

EB&S aims to invest in businesses rather than in marketable securities. It is not looking for a majority or controlling interest but for substantial minority interests.

As part of its philosophy of investing in businesses rather than in marketable securities it plans to enter situations in which it will be ready to back up its original investment with additional cash.

A flexible attitude has been developed toward size of company best suited for EB&S electronic investment program. However, the managers of the program have decided against investing in either the largest companies of the industry or in those operations which are still in the invention stage.

MERGERS, ACQUISITIONS and FINANCE

Royal McBee has acquired a 25-percent equity in **Tally Register,** a Seattle research and development firm. Royal had previously acquired some of the firm's common stock. The two firms have entered into a new contractual arrangement. Royal will manufacture and market automatic office equipment using Tally Register developments. Royal will also manufacture computer components for Tally Register which are to be used in special-purpose machines to be developed by the Seattle firm. Tally will become one of the companies affiliated with **Royal Precision.**

Prudential Insurance will build $14 million worth of office, manufacturing and laboratory facilities for **Lockheed Aircraft's** missile-systems division at Sunnyvale, Calif. and at Stanford Industrial Park. When the facilities are completed, the missiles division will occupy them under 25-year leases with option for renewal.

Beckman Instruments, Van Nuys, Calif. is actively looking for other instrument companies to acquire and is presently negotiating with four or five companies. Beckman may issue a small amount of stock this year if any of its acquisition plans materialize. To provide cash for growth requirements the instrument company expects to continue to issue stock dividends. The first dividend since Beckman became publicly owned in 1952 was a three-percent stock dividend, paid last year.

Westinghouse president Gwilym A. Price recently said that in 1957 Westinghouse may reinstitute an employee stock-purchase plan. The new plan would include more hourly employees than the previous, discontinued stock purchase plan, Price said.

Consolidated Electronics, N. Y. is working on plans to purchase **Sessions Clock,** Forestville, Conn. Plans call for Con Electron to receive an option to purchase the assets of Sessions and to provide the clock company with management assistance and a credit line.

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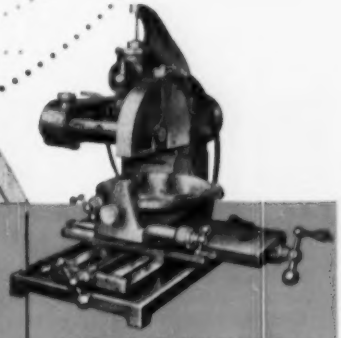

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WASHINGTON report

U. S. MAKERS OF GUIDED MISSILES and other advanced weapons systems can look forward to a new chunk of business: The government is getting ready to supply Britain's needs as British weapons come to the production stage.

This is the outcome of the talks between Duncan Sandys, British Defense Minister, and U.S. officials. Details will unfold slowly. Perhaps the first good look will come in the British budget, due soon. More may come from a Sandys-Eisenhower meeting in March.

• American and British experts are working out details. But the basic objectives are agreed upon—substituting advanced weapons for conventional forces and reducing the British defense budget.

• British want to pare defense costs, free more technicians and industrial capacity to work on export goods.

• Roughly one-third of all British technical and scientific personnel are now in defense production. This ratio would rise as missiles come into production—unless the U.S. geared American missile-making plants into producing for the British as well as ourselves.

• The Administration already has about $500-million available to pay for advanced weapons for NATO allies. It will ask for at least this much again to cover fiscal 1958, which begins July 1, 1957.

Stumbling block may be Congress: Solons fear the eventual price tag. They know that in about five years the cost of the U.S. guided-missile program may run $5-billion a year or more. If British needs are added to our own it's easy to see billions added to defense cost.

Threaten B-52 or MISSILE cutback

Would-be budget cutters inside the Administration, Secretary of Treasury Humphrey, for instance, base their real hopes for government economy on cutting back either the guided-missile program or the spending for B-52 bombers. Their argument: we don't need both missiles and B-52s since both are designed for the same job.

Patent office is after more money for computer and punched-card systems to speed up operations. Electronic devices can speed up searching patent files, cut down the heavy backlog that holds up rulings on patent applications.

New guide-book on the tax deductions allowed for electronic equipment is in the works. The Internal Revenue Service plans to launch a revised updated version of its Bulletin F—ground rules for annual depreciation deductions for electronic equipment. Revision is designed to bring tax life of equipment into line with the harsh facts of technical obsolescence.

IBM data-processing system is making a dent in the Central Military Catalog. Since 1952, the Defense Department has been at work getting uniform identification of the three million shelf items bought by the services. Each now has its distinct name, number and description. The new system speeds up assigning stock numbers, updating files and should help reduce duplication of purchasing and storage.

HOW LONG A WORD IS..

service

The Dictionary says "Service" is "The Act of Helping another or promoting his interests in any way."

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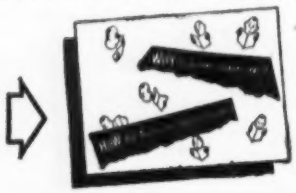

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One of a series of ads prepared by
THE ASSOCIATED BUSINESS PUBLICATIONS

EXECUTIVES in the news

WEATHERMAN Mauchly explains electronic forecasting to Remington Rand v-p Ensinger, far left, and the press. Listening at right: statistician Max Woodbury

NEW MEMBER in the ranks of IRE Fellows is John W. Mauchly, director of Remington Rand's Univac Applications Research Center. The job's an apt one for the 49-year-old scientist who believes "you can make a machine to do anything that you can precisely describe."

Mauchly, a native Ohioan, is one of many physicists who were pushed into their careers by the weather. He became interested in meteorology at Johns Hopkins, where he got his doctorate degree. Knowing that long-range weather forecasting requires processing large masses of data, he began looking for a way to do the job fast. He toyed with counting circuits.

The war found him in the physics department of the University of Pennsylvania. When Army Ordnance wanted Penn to compute ballistic data in a hurry, Mauchly suggested an electronic calculator. The result: Eniac, first of his brain children (he has six human ones).

Mauchly and associate Pres Eckert subsequently left Penn, formed a company and built Binac, later Univac. This third brain child was almost stillborn—the little company's backers were killed in a plane crash, and funds ran out. Mauchly and Eckert sold out to James Rand, and in 1951 their big commercial computing system was accepted by a customer.

"Incorrigibly curious," one of his friends says of Mauchly. His home gives ample evidence of varied interests, from books scattered all over the house, to the piano, to the printing press in one wing. Weather forecasting, his great interest, led him into astronomy, planetology, physics, electronics, even history.

Strictly PERSONAL

Dear Sir:

. . . If it is possible—and I think it is—to develop an efficient electronic method of converting sea water to palatable fresh water, and to do so in an economically feasible manner, I believe the effects of such a discovery would have almost as great an influence on the economy of the world at large as the discovery of atomic energy has had to date. . . .

I believe improvements in our electronic aids for air traffic control would probably have the greatest bearing on the air transportation picture. . . .

I visualize some device which would combine the function of our weather radar, radar transponders, collision prevention and warning gear, and (would) provide the necessary navigation and instrument landing requirements, in a simplified form. (This device) would provide all of the necessary elements for air traffic control and air navigation without the present terrific complexity of having to have so many so-called black boxes. . . .

E. V. Rickenbacker
Eastern Airlines
New York, N. Y.

Editor:

In the article . . . entitled "Your stake in Color Tv" (Jan. 10, p. 15) it is stated: "General Sarnoff says 'RCA alone will produce and sell 500,000 color television sets in 1957'."

I would call your attention to General Sarnoff's Year-End Statement in which he said: "RCA's goal for color television in 1957 is to produce and sell 250,000 color sets."

Orrin E. Dunlap Jr.
Radio Corp. of America
New York, N. Y.

Editor:

The standard complaint of all modern businesses is poor communications among operating executives and supervisors. The deficiency which is felt most painfully is lack of timely and accessible news of the plans, performance, status and intent of other men whose output must be matched.

It is not hard to imagine a high-capacity intraplant information exchange, with selectors and collators at each user's office which electronically produce reports . . . on whatever he asks for, and to which he feeds his ideas and reports.

If cheap and reliable, this development is what the country needs. Executives would be much more effective after learning how to use this sort of system.

Mark G. Foster
Avco Manufacturing
Cincinnati 15, Ohio

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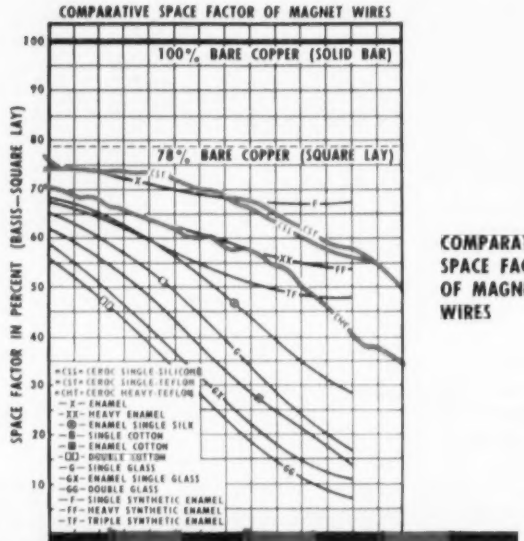
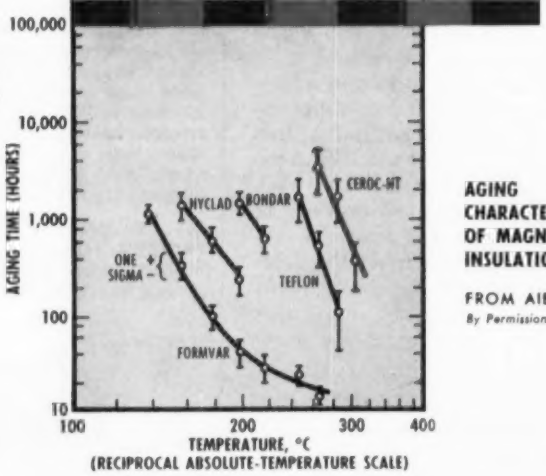


COMPARATIVE SPACE FACTOR OF MAGNET WIRES



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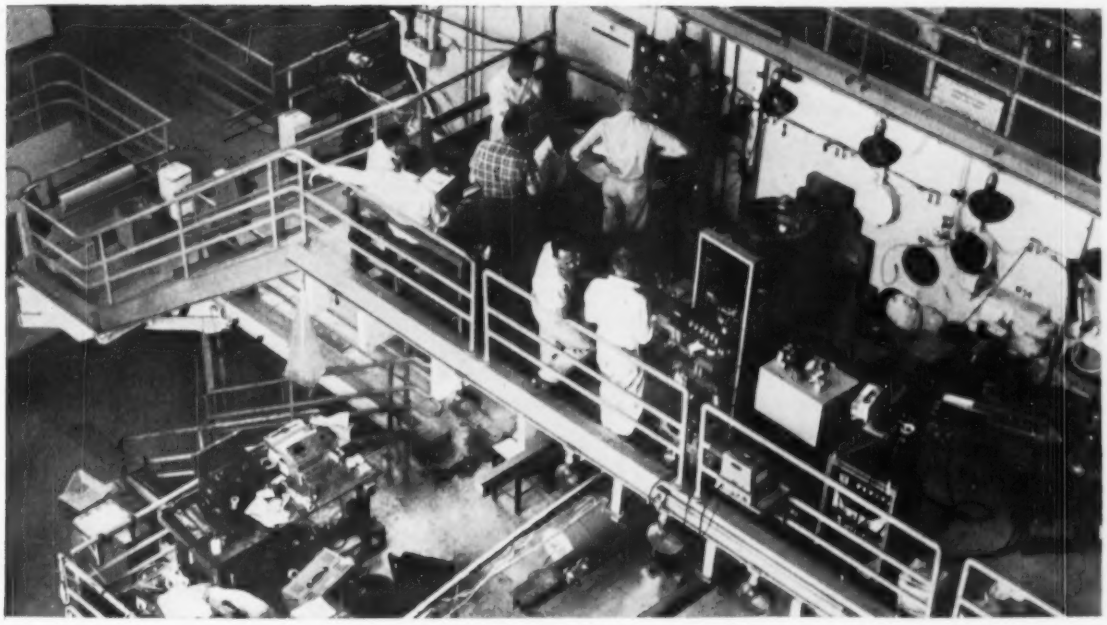
FEBRUARY 20, 1957



ELECTRONIC research equipment at Brookhaven National Laboratory. When reactor instrumentation will become a booming industry hinges on . . .

ATOMIC POWER: sooner or later?

Private investment reaches $500 million committed and planned
Instrumentation, primarily electronic, will take about 7 percent
Future hangs on atomic fuels proving competitive with coal, oil

PRIVATE investment in atomic power now stands at $500 million, committed and planned, compared with $50 million two years ago. Instrumentation, primarily electronic, will account for about seven percent of this sum.

The present annual dollar volume in atomic electronics, however, is something few care to guess. An AEC source's estimate of "under $15 million" jibes with a Westinghouse estimate of $12 million. But the future is rosier.

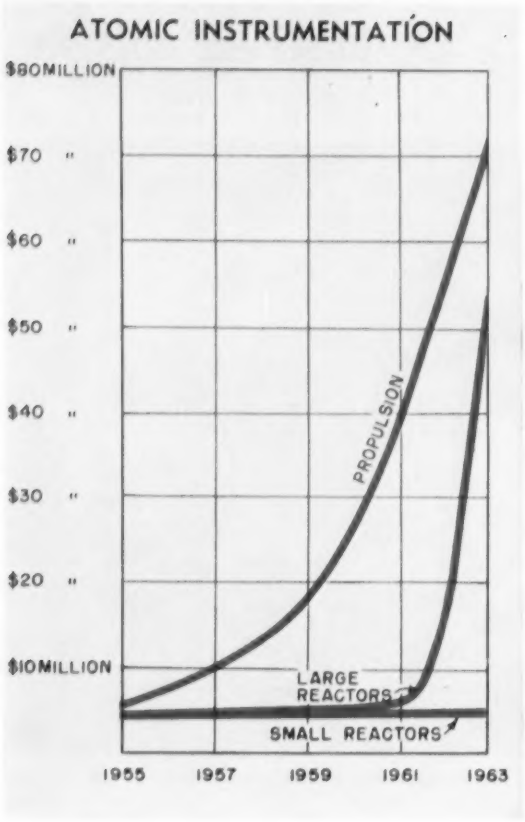
The Atomic Industrial Forum forecasts instrumentation sales rising from over $10 million in 1955 to $135 million in 1963 if all goes well.

AIF made its survey in 1955 and now feels sales thus far have borne out its predictions. But the future depends on civilian power reactors.

If civilian power hangs on the vine, the more sizable market will be military propulsion. At maximum, reactor sales would reach $1.5 billion annually in 1956; at minimum, $550 million.

Instrumentation cost varies from reactor to reactor. One approximation considered useful is $50,000 for a small reactor, $200,000 for large research reactors and $300,000 for power reactors.

Leeds and Northrup's observation is that instrumenting a power reactor runs $3 per kilowatt;



research reactors, 10 percent of installed cost. American Machine and Foundry estimates instrumentation is 13 or 14 percent of the cost of a boiling-water reactor, excluding the turbogenerator cost.

On two AEC reactors, costs are $300,000 and $340,000. The latter is an early model with surplus safety built in.

GE atomic engineers estimate that electronic equipment varies from one to six percent of the cost of the reactor complex proper. The percentage for the 180,000-kw reactor in Dresden, Ill., is 1.2 percent. The AEC lists the cost of that reactor at $34 million, indicating the instruments will cost some $400,000.

Reactors generally require neutron-sensing devices, emergency controls, recorders and health-safety instruments. Replacement costs reach 25 percent annually because of difficult and continuous operating conditions.

Equipment includes ionization and fission chambers, scintillation counters, personnel monitors, fast-pulse and logarithmic amplifiers, multichannel analyzers, heat and pressure indicating systems, remote operating, recording and viewing equipment.

Some 222 reactors are built, abuilding or planned. Of these, 59—17 privately financed—were contracted or begun in 1956. Eight civilian power reactors will be operating in 1960.

Should atomic power prove competitive, that and rocketing electricity demand will push atomics over the hump. A survey for Congress saw up to $27 billion invested in civilian atomic power by 1980.

Atomics is already a fiercely competitive business. Up to 300 firms are active, including 90 instrument firms, and over 2,000 indirectly.

AEC frees more patents

ELEVEN MORE electronic items are on the list of royalty-free patents available from the Atomic Energy Commission.

- No. 2,762,941 positive ion electrostatic accelerator, by C. M. Turner: method and apparatus for improving the performance of electrostatic generators.

- No. 2,763,816, spark gap, by W. R. Baker: relay that may be triggered by overload in radio-frequency line to isolate equipment that may be damaged.

- No. 2,764,689, pulsed oscillator, by W. C. Struven: oscillator delivering constant frequency a-c when triggered.

- No. 2,764,707, ion source, by R. B. Crawford et al: a high-density accelerated ion beam source in which pulse and magnitude may be controlled and no gas is produced between pulses.

- No. 2,769,094, time-of-flight neutron spectrometer: measures energy level of neutrons from various materials.

- No. 2,769,903, pulse-forming network, by G. D. Paxson: synchronizes low-repetition-rate triggering pulse with sinusoidal voltage signal.

- No. 2,770,128, electronic pressure-differential wind-direction indicator, by H. Moses: rapid, inertia-free sensing and recording apparatus.

- No. 2,770,684, limited amplifier, by R. E. Thomas: circuit to prevent large signal from overcharging interstage coupling capacitors.

- No. 2,770,755, linear accelerator, by M. L. Good: permits radial focusing of ions while maintaining phase stability.

- No. 2,770,756, automatic beam stabilization, by R. J. Klein: improved memory system for computer using cathode-ray-tube storage of binary information.

- No. 2,771,582, phase meter, by C. N. Winningstad et al: applicable to a-m or f-m phase measurements when frequency of the source is not stable.

MAGNETICS vs transistors

Heat from electron tubes plagues computer designers
Both transistors and magnetic amplifiers produce little heat
For some uses magnetic amplifiers have the edge

ASCENDING STAR of the transistor is being challenged in some computing and switching circuits. Pulse-type magnetic amplifiers are making a small stir. Engineers feel magnetic circuits may surpass transistors for economical solution of some high-frequency pulse problems.

Magnetic amplifiers, like transistors, require no heating, take up little space. With a core one-tenth of an inch in diameter, an amplifier with three or more windings may be only as big around as a cigarette.

Two magnetic amplifiers, mounted in a protecting capsule with leads and pins, are about the size of a four-high stack of nickels. Complete packages containing an operating circuit with miniature components are little bigger in diameter than a quarter.

Pulse-type magnetic amplifiers are essentially small transformers wound on a core of ceramic ferrite or thin alloy tape wound on a stainless-steel bobbin. Circuit behavior of the device depends upon the shape and composition of the core as well as the number of turns in the various windings.

This gives the designer a great deal of flexibility in fulfilling his requirements. Principal users so far are computer makers, who have also done a lot of the development work.

Magnetic circuits are one solution to computer overheating problems. Some computers produced in 1950 used 5,000-odd electron tubes and needed upwards of 25 tons of air conditioning to keep the thermionic fever down.

Transistors provide an alternative to tubes but

Learning to control the BIG ONES

EIGHT magnetic amplifiers are used in DC-6 and DC-7 airplane procedural trainers for familiarizing flight crews with cockpit operating techniques. The instructor can introduce problems for the crews. Burton Rodgers Technical Training Aids built the trainers from American Airlines designs

transistors capable of amplifying high-frequency pulses satisfactorily can be expensive.

Aided by the work of Harvard computerman Howard Aiken and Naval Research Labs' Robert A. Ramey, several big and small computer and component manufacturers set out to investigate magnetic pulse circuitry. Concentrated research began in 1950 and bore fruit as early as 1954. One computer firm began marketing magnetic components in 1955.

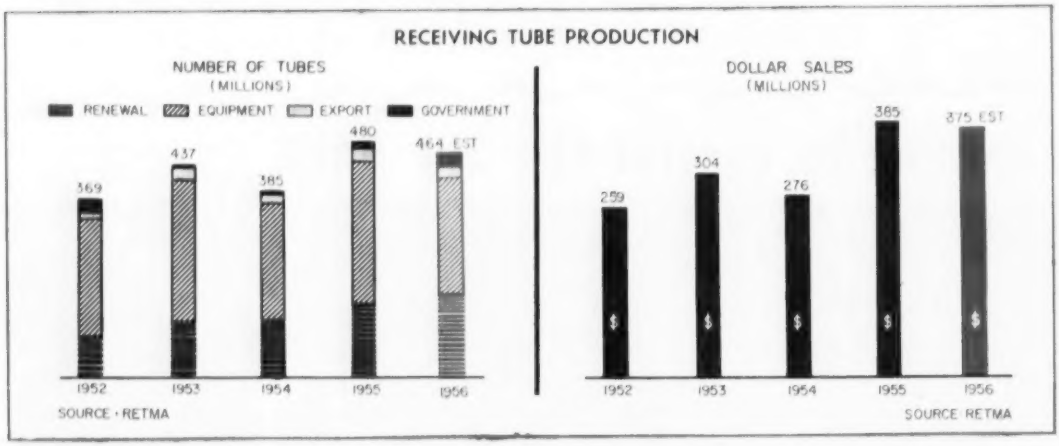
By the end of 1956, annual sales of magnetic amplifying and switching components by one company alone were about half a million dollars. Over a hundred companies are now in the magnetic-amplifier business.

Other computer firms have stacked most of their chips on the transistor. However, all computer firms are developing magnetic core-storage and recording devices.

Magnetic amplifiers are able to handle high frequencies at high power outputs. They require few resistors and capacitors, since they perform many of the functions of these so-called passive elements. Magnetic circuits do, however, use semiconductor signal diodes. Some circuits could even use transistors.

Present use of pulse magnetic amplifiers seems limited to synchronous pulse work—pulses recurring in predictable patterns. This is because they use a pulse pattern as a power source, instead of a steady-state voltage. Frequently, transmitter-type electron tubes provide this pulse pattern. With further circuit development, the requirement that magnetic amplifiers work synchronously may be circumvented. Magnetic-amplifier proponents think they can soon compete on an initial-cost basis with electron tubes, claim higher reliability, smaller wearout rate and greater stability.

PRODUCTION and SALES statistics



Receiving tube sales in 1956 ran slightly behind 1955. RETMA reported sales of 430 million tubes with a manufacturers' sales value of $345 million in the first 11 months of 1956. Unit sales were down about three percent from 1955. Dollar volume was up five percent due to higher prices. Total sales for 1956 will be about 464 million tubes with a value of about $375 million.

Receiving tube sales should hit $400 million in 1957 estimates GE's components manager, L. Berkely Davis. About $100 million of this will be in industrial and military types, the major area of receiving-tube market expansion, Davis says.

Renewal tube sales are also expanding. In 1952 renewal sales accounted for 18 percent of all receiving tube sales. Currently they represent about 43 percent of the total.

Tv and radio set production for 1956 was below 1955 levels at the end of November. Cumulative tv production through November was 6.8 million sets compared with 7.2 million in the same period of 1955. About 12 million radio sets were produced, some 600 thousand less than in 1955.

Retail outlets sold 5.9 million tv sets in the first 11 months of 1956 compared with 6.5 million units in the same period of 1955. Radio sales, excluding auto, fared better at retail. Some 6.7 million sets were sold in the 1956 period compared with 5.5 million in the preceding year.

TRAINING upgrades manpower

Rapidly growing technical staffs require specialized training
Some men can go back to school part time at company expense
Often, however, the school must come to the plant

A SCHOLARLY looking man with a bulging briefcase walked into a Philadelphia electronics plant the other day. He was a physics professor from Massachusetts Institute of Technology and he had come to teach solid-state physics to his weekly advanced class of engineers.

The use of visiting professors is one of many steps that electronic manufacturers have taken to get more mileage out of their technical manpower. Many electronics firms have doubled their technical staffs since the Korean war and the need for specialists must often be met by on-the-job training.

For example, here is how Philco has gone about the overall problem: the firm here has 2,000 men in research and engineering, of whom more than 900 are engineers with degrees ranging from B.S. to Ph.D.

More than 400 employees, 75 percent of whom are engineers or scientists, pursue courses at various educational institutions with the company paying up to $225 a year tuition.

G. B. Fadden, personnel director, says the company does everything possible to "find out how many jobs can be done by technicians instead of by engineers." To further this aim the company tries to develop the skills and potentials of young men hired for the drafting department as "junior detailers." These men are high-school graduates with a year of mechanical drawing who have passed an aptitude test and are put through an eight-hour-a-day training program.

Another problem is upgrading engineers to supervisors. Philco called in Penn State University to conduct a survey to determine what was needed to improve the caliber of supervisory personnel.

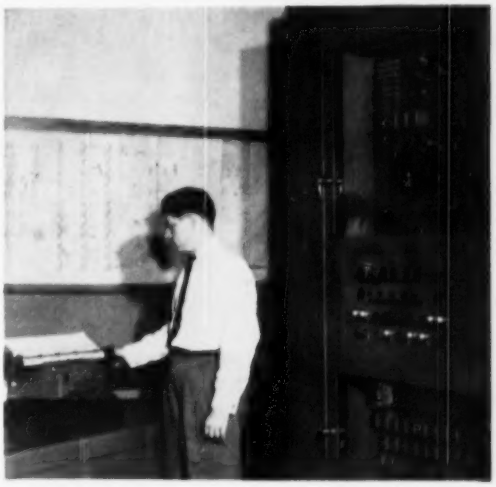
The outcome of this survey was the establishment of a special course of study known as the "Research and Engineering Supervisory Development Program" which ran for two years. Persons enrolled in this program attended a one-hour-a-week class for 15 weeks.

In many electronics plants and laboratories technical seminars are also given by experienced engineers. Department heads often map out courses in such timely subjects as transistor principles.

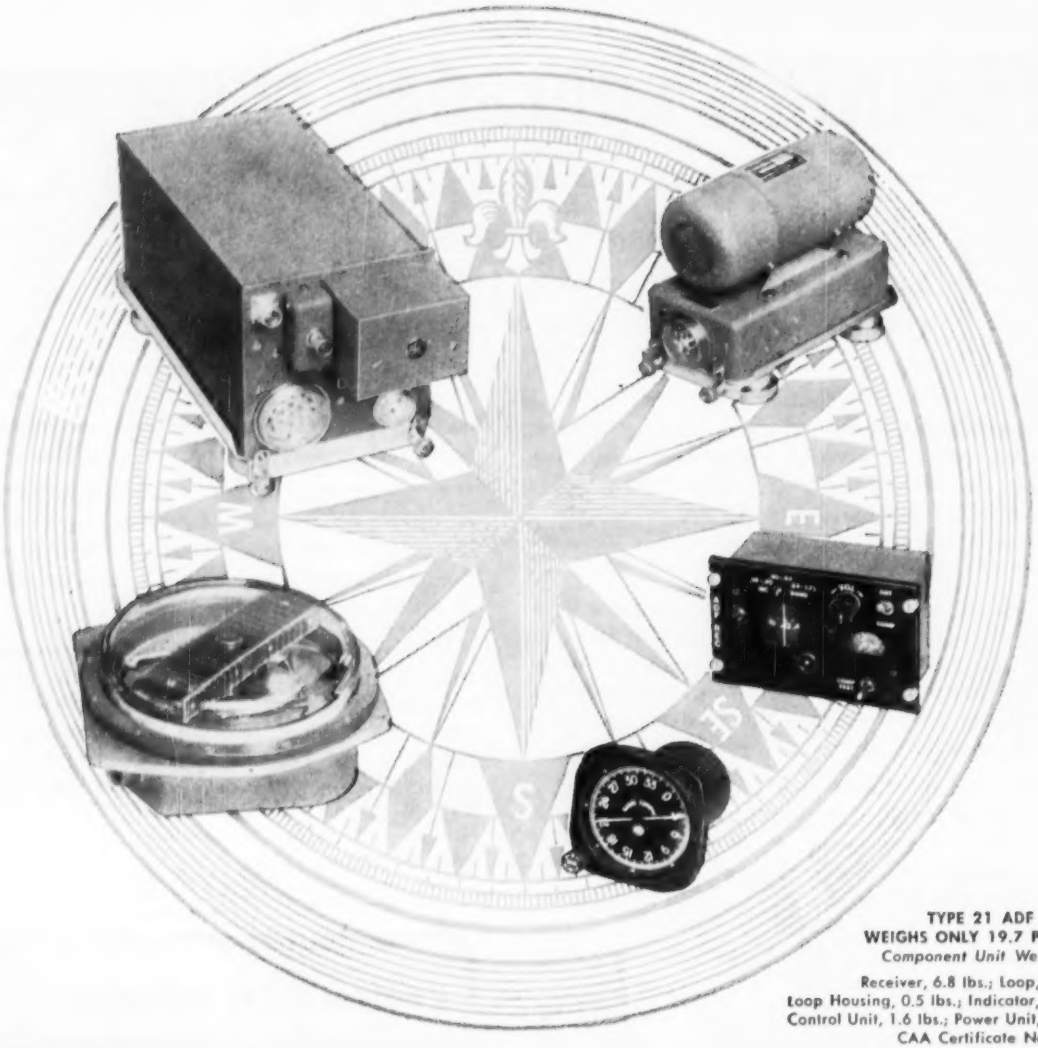
At Bell Telephone Laboratories young crew-cut engineers carry textbooks under their arms and chat about Boolean algebra. They are students at the Communications Development Training program set up by Mervin J. Kelly, president.

Students have been hired with the understanding that they will complete from two to three years of intensive training in communications technology before being assigned to regular departmental positions. Students generally must complete three years of the program if they are graduates with B.S. or M.S. degrees.

Controls OIL refinery



ANALOG computer and automatic data-logging system will guide process control at Esso's Belot refinery in Cuba. Designed by Fischer and Porter, it calculates 11 operating guides and 101 critical process variables



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ARC

$1,000 COMPUTER coming

Cryogenics may lead to inexpensive computer memories
There are potentialities in infrared equipment also
100 labs carry on low-temperature work

NEW DATA-PROCESSING equipment for the Department of Defense, under production by A. D. Little, Cambridge, Mass., will use components based on science of cryogenics. In 10 years, research in cryogenics may make possible $1,000 versions of computers now costing $1 million.

What is cryogenics? In essence, it's the study of how materials behave at temperatures down near absolute zero.

Key to a $1,000 computer may be an information-storage device based on the science of cryogenics, called the cryotron. In its simplest form the cryotron is a straight piece of wire about $\frac{1}{10}$ of an inch long, wound with a single layer of control wire about the size of a human hair.

The cryotron operates in a bath of liquid helium, only a few degrees above absolute zero. Many metals, at such extreme low temperature, are superconductive. That is, they offer no resistance to electrical current passage.

The cryotron depends for its operation on the fact that superconductivity can be destroyed by application of a magnetic field. Therefore, the presence or absence of current in the magnetic control winding can be arranged to mean the difference between resistance and no resistance in the straight wire.

Cryotrons, like transistors and electron tubes, can be interconnected to form the heart of a computer. And here are some factors that make them attractive: Unusually small size, exceptionally low cost, high reliability, fewer components needed.

It makes possible building a large-scale digital computer that will occupy only one cubic foot, exclusive of refrigeration and terminal gear.

So far cryotrons don't match transistors and electron tubes in switching speed. But it's expected the speed can be boosted a hundredfold by further research and development.

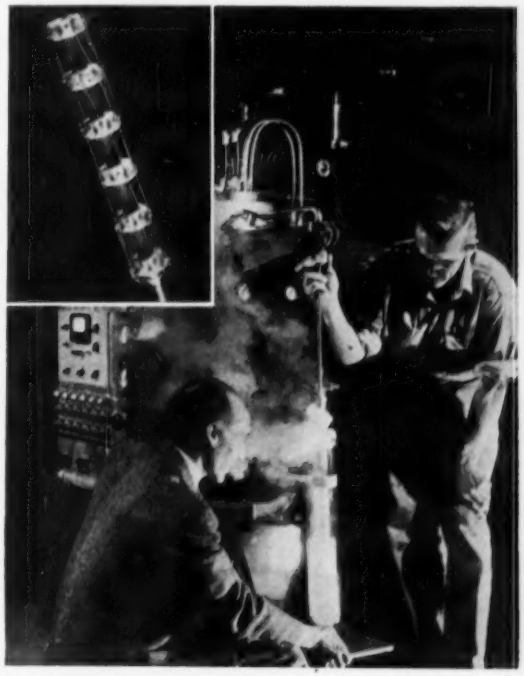
In time cryogenics may improve radar reception 100 percent.

Cryogenics also may improve infrared detection in many ways. And it will help explore the phenomenon of superconductivity. These are among the possibilities. At present, work in the computer field seems most promising.

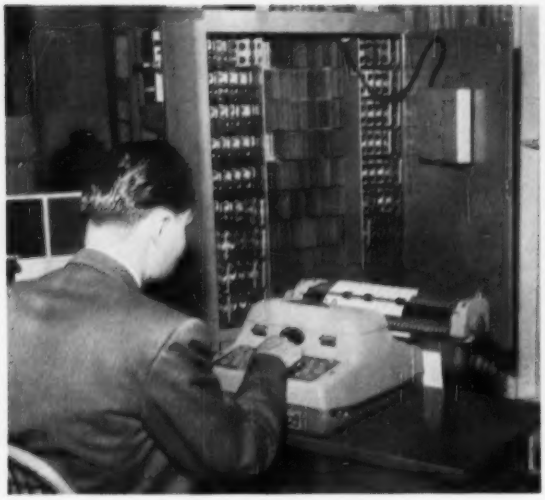
About 100 laboratories throughout the world are doing cryogenics-electronics research.

They spend from $10-12 million annually. From $1-2 million is expended for production of equipment.

If an electronics firm wants to get into low-temperature research, cost for basic facilities is $30,000. One necessary piece of equipment is the cryostat—a unit which makes liquid helium used for low-temperature research.



WITCH'S brew of liquid helium (above) plays key role in operation of an eight-stage multivibrator (insert)



REDUCED size and power needs . . .

SIMPLIFIED programming; reasons why . . .

Small COMPUTER sales rise

It's dandy to have a big computer for man-sized jobs
But why send a man on a boy's errand?
Small machines help break computing bottlenecks

SMALL ELECTRONIC COMPUTERS, pigmy cousins to the million-dollar giant brains, are simplifying industrial and commercial data-processing. In a sense, they may be reversing a trend toward centralization of calculating facilities in research. Development of automatic computers that are small and easy to operate gives the engineer a tool he can use directly.

DESK-SIZE brains give engineers, small business, direct access to needed computing facilities

More small computers will be built in 1957 by a growing number of manufacturers. Early sales indicate that they may become one of the biggest slices of the computer market.

Manufacturers cut the frills on the small computers, build fast, efficient calculating machinery with simple input and output. Burrough's E101, for example, looks like a bookkeeping machine and uses a pinboard for program control. Bendix's G-15 has a typewriter for input and output. The Magnetic Calculator built by Remington Rand for the Air Force has a typewriter and paper-tape devices.

These simpler machines cannot do the information-handling jobs of a Univac or an IBM 705. Limited reading-writing abilities prevent their handling masses of data, such as a large insurance company's files.

Their best use is for small commercial jobs and for relatively simple scientific and engineering problems. Here the small machines are frequently as fast as their larger relatives. They can be used right in the laboratory or shop, programmed by the engineer.

When big computers first hit the market, organizations that installed them tried to make the most of their investment. Many took away the engineer's desk calculator, centralized the computing operations. An unexpected jam developed when jobs poured in.

All the engineers were doing different problems. In many cases the computer had to do commercial accounting as well. Programming all this work became a bottleneck. The engineer either went back to his sliderule or held up his work.

The small computer can break this jam. It upgrades the big machine to major jobs, gives the engineer the computing tool he needs. Several industrial firms that need both commercial and scientific computing find that one central facility, with several smaller ones on the fringes, works out smoothly.

Decentralization will also move into commercial processing, but more slowly. Machines like Logistics Research's Alwac, the Univac 120, and IBM's family of smaller machines, are turning up in outlying offices of large corporations owning or renting IBM 700's and Univacs.

The small machine gives local management the facility it needs, passes data on to the big computer in the home office. The big computer consolidates the reports and does the corporate computing and recordkeeping.

More economical computers will depend on cheaper components. Assembly costs have already been cut, are now less than half the factory cost of a computer. Industry hopes for cheaper conponents of acceptable reliability to appear on the market. Manufacturers feel that with such components they can put the capacity and flexibility of large-scale systems into smaller packages, and sell them at prices within the reach of small and medium-sized business.

GIANT in computerland

LATEST ENTRY in the race for the giant computer market is the IBM 709, a $3-million system ordered by Union Carbide & Carbon.

Instead of using the binary-coded decimal language employed heretofore in many computing systems for handling business data, this latest offering uses pure-binary operations internally. Pure binary operation, which offers certain advantages in speed and flexibility over binary-coded decimal operation has usually been restricted to scientific computers.

Three conversion instructions help the user translate from number bases such as decimal into binary code, although some special coding procedures are necessary. The machine can also handle alphabetic characters.

The idea for the new system is said to have come from some of the commercial applications of IBM's scientific 704 system.

Technical DIGEST

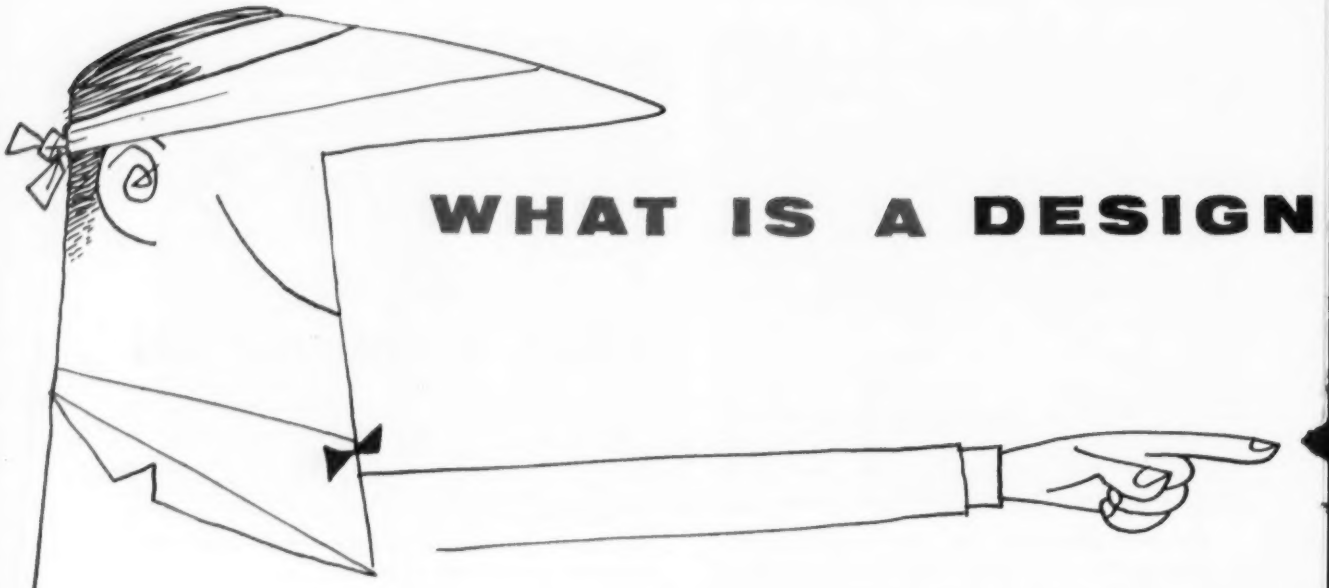
Potting in sand is GE's solution to the problem of producing electronic circuits that will withstand the awesome environmental combination of 100 g shock, 500 C temperature and high nuclear radiation.

Servo Corp. of America has built a complete infrared radiation laboratory small enough for mounting in a bomber. The equipment measures, analyzes and records heat radiation given off by a new plane or missile in flight under all day and night weather conditions. Infrared importance increases as infrared detection schemes increase in sensitivity.

Dry or impotent circuit action of relays continues to mystify engineers. The condition occurs with relay contacts carrying currents of the order of microamperes and makes the relay miss or stay open unpredictably. Even hermetic sealing does not prevent formation of some unknown insulation between the contacts. Missile manufacturers are most concerned, because one false operation of a missile relay generally means missing the target.

Transistors revive hopes for practical heat-operated radios. A collar-type thermopile on top of the glass chimney of an Aladdin paraffin lamp generated enough power for operating a transistor radio with loudspeaker volume in tests at Philips Research Labs in Eindhoven, Holland. The setup used 200 Chromel-constantan thermocouples welded together, with half of the junctions in the stream of hot gases coming out of the lamp chimney and the other half pointing outward for air cooling.

A radiation-resistant television camera with its own light source and sideways-viewing mirror has been successfully developed by Pye in England for inspecting the interior of the Calder Hall atomic power-plant reactor when shut down. The camera is completely housed in a stainless-steel cylinder only 3½ inches in diameter and 40 inches long, and can withstand 200 C. All components are encapsulated to permit decontamination.



WHAT IS A DESIGN

HE SHOULD BE CALLED A WORKING ENGINEER!

electronics magazine has completed an informative study.* It's purpose was to determine whether **electronics** reaches the men who specify, and therefore actually purchase, electronic components. We asked respondents to our questionnaire to list the titles of those making purchasing decisions, and their answers confirmed our knowledge that engineers who create and supervise the assembly of new electronic components or equipment cannot be defined as "design engineers." 98 separate titles were listed in all. Among these men, working engineers who specify and make the decision for purchasing electronic equipment dominate.

Working engineers comprise 74% of the purchasers in this 36-company study, "administration" personnel account for 20.2%, and "production" personnel only 4.2%.

electronics has a 46,000 paid-for circulation, and is published three times a month — a regular Technical Edition on the 1st, and Business Editions on the 10th and 20th (because of the vital concern of the electronic working engineer with the commercial side of his industry).

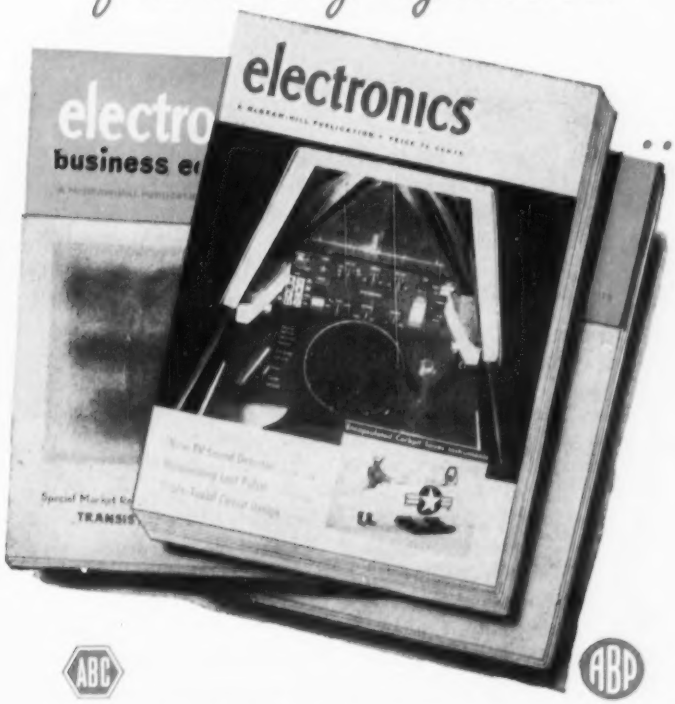
Write for copies of "electronics** Reaches the Men Who Specify Your Product"—a 36-company survey to find out who buys the 13 classifications of products that comprise 34% of **electronics** advertising pages*

ENGINEER

How do you sell to the electronic market?

Engineers specify products on the drawing board. When design is approved, and mass production goes into full speed, the *specified* products are, in most instances, bought in quantity. Therefore, to get mass sales in the electronic field, advertise in the magazine that is read by working engineers. That is a simple story.

to sell the electronic market,
use the working tool
of the working engineer . . .



. . . of course!

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Project Engineer
Supervisor
Mechanical Engineer
Design Engineer
Component Engineer
Section Head
Engineer
Chief Engineer
Director of Engineering
Materials Engineer
Department Head
Senior Engineer
Department Manager
Project Leader
Unit Chief
Group Engineer
Research Engineer
Development Engineer
Systems Engineer
Designer
Executive Engineer
Senior Electrical Engineer
Product Manager
Specifications Engineer

U.S. seeks CONTRACTORS

Selling the government is big business and it's growing
But competition is keen and the fine print can trip you up
Subcontracting is often the best bet for smaller firms

COMPETITION FOR DEFENSE contracts is sharp, but it is a market few electronics firms can afford to overlook. About a fourth—over $3 billion in 1957— of electronics sales are to the military.

A firm without military contract experience has little chance of getting a really large weapons system contract, Sperry Gyroscope warns in a current analysis of defense contracting. Making systems is becoming increasingly complex and requires large engineering staffs.

Competition for established items is stiffening as more and more firms set up military electronic departments.

Best bet for small firms is probably subcontracting. Even the largest firms must divide systems contracts into manageable portions. In the Long Island area around its main plant, one company spends over $15 million a year with 1,121 subcontractors and suppliers, of which 988 have fewer than 500 employes.

Quality is a key requirement of subcontractors because a defect in one subassembly can block an entire systems program.

Radio Frequency Laboratories, a medium-sized firm specializing in test equipment, agrees that subcontracting is the best entry to defense work. It also has the advantage of developing future commercial markets. Be content, though, RFL says, with low-profit orders until a reputation with the prime contractor is established.

To keep capital revolving efficiently, one company averages its backlog at three months. Rising costs can squeeze profits from long-term contracts or contracts with increased option clauses.

Other hazards manufacturers have learned to avoid through experience include price redetermination contracts. Some say all allowable costs should be nailed down beforehand with the purchasing officer. They watch for special packaging and finishing specifications and hidden overhead in inspection delays and security requirements.

Be wary of putting a competitor in business with a product you developed, another company says. A lower bidder may win the next contract. The only protection is discretion or a basic patent.

Government regulations require that all suitable contracts be reserved for small business. Unless there is an overriding reason, at least one-fourth of contracts over $1 million must be subcontracted.

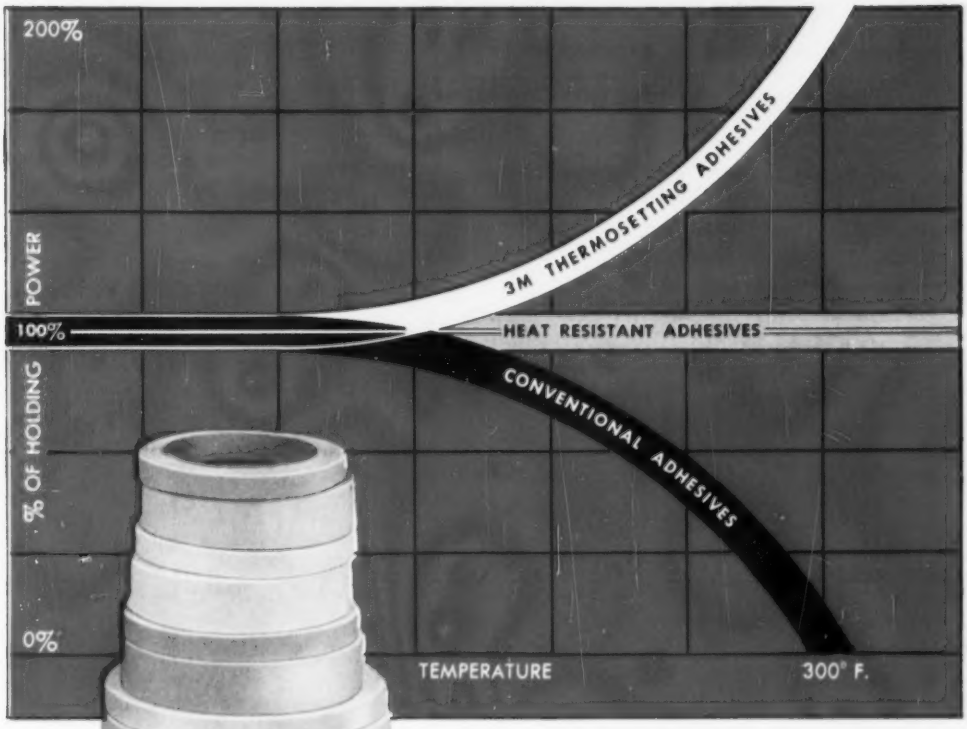
Pressure to spread defense work further is mounting. The Senate Small Business committee was "seriously disturbed" that small business's share dropped from 25.3 percent in 1954 to 19.6 percent in 1956. Attorney General Brownell has urged it be made easier for small firms to get development projects.

Most purchasing agencies have set up branches to foster fuller participation. The Small Business Administration keeps firms registered with it advised of suitable contracts offered. It sponsors meetings at which firms can meet with representatives of agencies and prime contractors.

Three government publications tell which agencies buy what. Purchasing and specifications directories are sold for 50 and 25 cents, respectively, by the Government Printing Office. The Department of Commerce sells a daily synopsis of procurement and contract awards for $7 a year.

SMALL BUSINESS Administration, military purchasers sponsor meetings to help firms get contracts.

NOW, a complete line of insulating tapes with improved Thermosetting Adhesive!



These "SCOTCH" Brand Tapes have thermosetting adhesives:

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"Scotch" Acetate Tapes
"Scotch" Glass Cloth Tape
"Scotch" Paper Tapes
"Scotch" Cotton Cloth Tapes

There's a big difference between pressure-sensitive insulating tapes with true "thermosetting" adhesives, and tapes with "heat-resistant" adhesives. The difference is *holding power.* Improved 3M Thermosetting Adhesive holds under extreme operating heat without softening . . . has high bond strength for anchoring leads . . . bakes dry to prevent throw-out . . . resists action of solvents, waxes, varnishes. The only tapes combining *all four* of these advantages are "Scotch" Brand Tapes with 3M Thermosetting Adhesives.

GREATER ADHESION • GREATER SOLVENT RESISTANCE • 50% MORE TACK • LONGER SHELF LIFE

SEND FOR FREE BOOKLET
illustrating and describing "Scotch" Brand Thermosetting Electrical Tapes. Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. CA-27.

The first true thermosetting adhesive . . .
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Attention centers on SSB

FCC intensifies single-sideband studies
Ham ssb market to expand in 1957
Military radio provides growing sales

PROCEEDINGS have begun at the FCC which look toward exclusive use of single-sideband modulation for radiotelephony on frequencies below 25 mc in the fixed and mobile radio services.

The potential advantage of nearly doubling existing spectrum space by using ssb intrigues the Commission. Many radio engineers savor the reduction of interference and fading effects brought by using only one sideband.

One area of communications is already sold. About 90 percent of commercial overseas radiotelephone circuits are using ssb. Conversion of the remaining circuits is being charted.

The military has been buying ssb transmitters and receivers at an increasing rate over the past two years. One manufacturer of ssb equipment thinks that within five years the military will be entirely in single-sideband communications.

Amateur radio is growing as a ssb market. A rough estimate of ham operators in ssb full time: 6,000. Twice that occasionally.

In the past two years one firm has sold more than $3 million in 1-kw ssb transmitters to amateurs. Receiver sales: more than $1.5 million.

Future sales of ssb equipment to the airlines may depend upon the outcome of the Arinc debate held February 1. The airlines have been interested in single-sideband for about two years. Collins put forth its views on ssb with suppressed carrier at the meeting. Kahn Laboratories pushed for a compatible ssb system. And GE held brief for double-sideband modulation but with suppressed carrier.

International considerations, however, may becloud the ssb picture. While ssb exhibits communications advantages, it requires more equipment. Other nations in the world do not have the pressing U.S. spectrum problem. The cost of changing to ssb may well be a deterrent to its early adoption abroad.

Video tape ahead for HOME

HOME video tape players are first step in coming revolution

HOME VIDEO MAGNETIC tape players may change the face of home entertainment. RCA has an experimental video-tape player. Ampex has similar plans.

RCA's model, using a standard tv receiver as its screen, plays back a prerecorded piece of magnetic tape. "The next step," says Douglas Ewing, RCA v-p for research and engineering, "is to give the consumer facility to record programs himself."

Ewing is convinced that "a device that can record and play back is no more complicated than a television receiver. Probably, it would cost somewhere around $200 to $300."

Home electronic photography also becomes a distinct possibility for the future. RCA sees hooking its new transistorized four-pound tv camera to a recorder-player.

Ewing sees electronic home movies as a way to bypass processing time. "With tape, it'll be a matter of seconds for Dad to see how pictures of the family turned out."

A-m broadcasting tries SSB

A-M STATION WMGM, New York, next month begins a three-month experiment in single sideband transmission. Conventional a-m receivers can receive the programs without distortion. The single-sideband modulation used in communications ordinarily requires special receiving equipment.

Leonard Kahn, head of Kahn Laboratories, is the man behind the test. He calls it a "new type of single sideband. It's not just full-carrier single sideband." Single sideband entails suppressing one of the two sidebands usually present in a radio signal. Many ssb systems suppress the carrier also. This requires reinserting the carrier at the receiver. Kahn's system neither transmits the full carrier, as is done with a tv picture carrier, nor does it suppress it so much as to require carrier reinsertion.

Kahn has attached an adapter to the a-m transmitter. The two components, of intelligence on the signal, phase modulation and amplitute modulation, are split. "It's then processed and you can pass it through any a-m transmitter."

Kahn expects to prove that not only can the spectrum be loosened up in the a-m broadcasting area, but that a-m can be made more palatable for the listener. "It'll double the fidelity. It does not have the noise reducing qualities of f-m, but for most listeners it'll compete."

electro-mechanical components to your *exact* requirements

SWITCHES
An infinite variety for every low-current application. Rotary, pushbutton, slider, lever, plug types.
SUBASSEMBLIES
Complete engineering and manufacturing facilities . . . one fully responsible source. (Shown: MT273E base, Bendix Radio Div.)
ROTARY SELECTORS
Thousands of combinations for remote control switching. Uses rugged, compact Oak rotary solenoid.
VIBRATORS
Basic designs built in numerous types meet a wide variety of requirements. Custom-designed and built.
ROTARY SOLENOIDS*
Manufactured as solenoid units only, or engineered into remote control subassemblies.
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CHOPPERS
Shown here is the new 605 unit that needs no phase-shift circuit. Other units in any frequency between 15 and 600 cycles.
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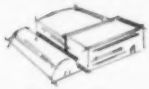
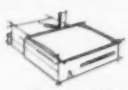
MFG CO
6V 400 CPS

Chicago, Ill.

Crystal Lake, Ill.



Chicago, Ill.



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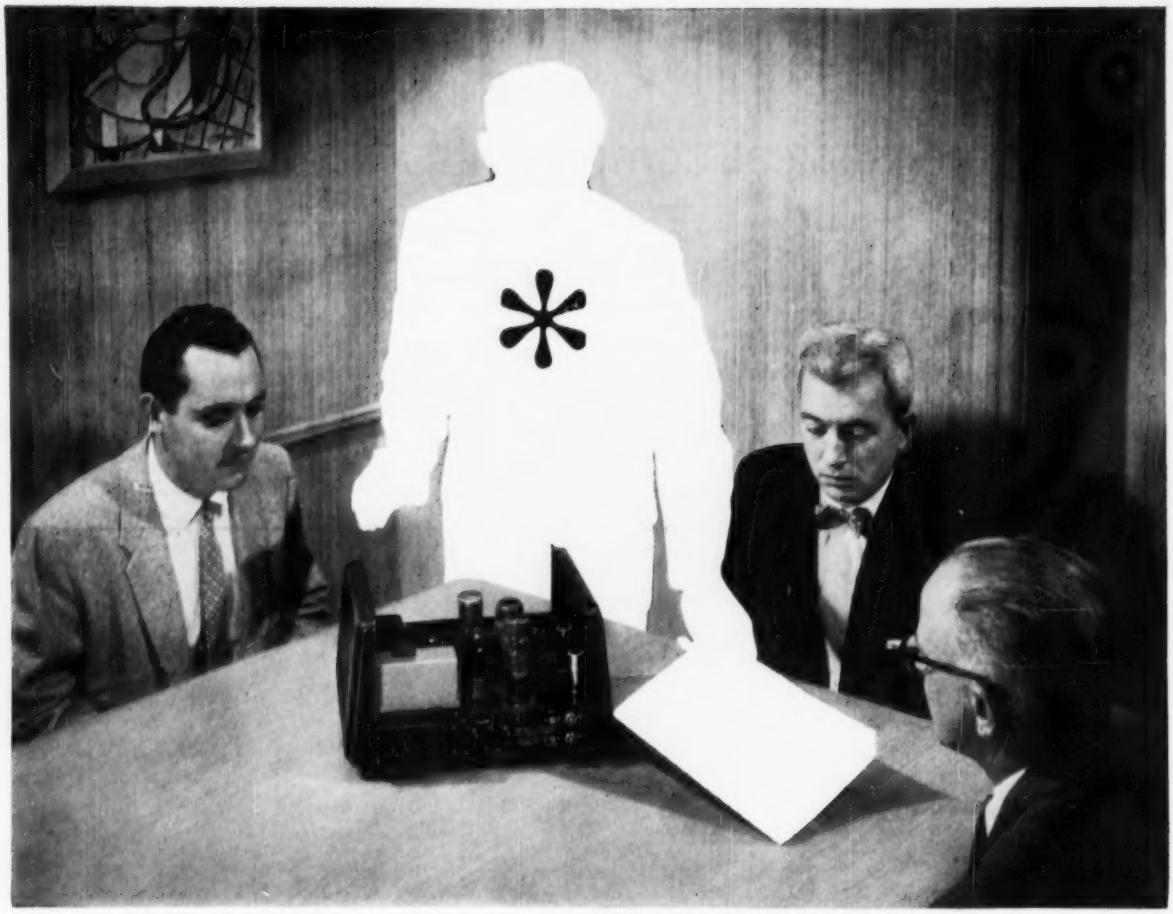

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Technical MANUALS can pay

Estimates are key to success
Book's size is poor ruler
Overhead is a big factor

THE DEPARTMENT OF DEFENSE spends an estimated $250 million annually on technical literature. A large share of this money goes for handbooks of operating and service instructions for electronic gear.

Managers of publications sections assert that a good cost estimate is a major step towards profitable operation. Even on cost-plus-fixed-fee contracts, profit is reduced when costs exceed the estimate.

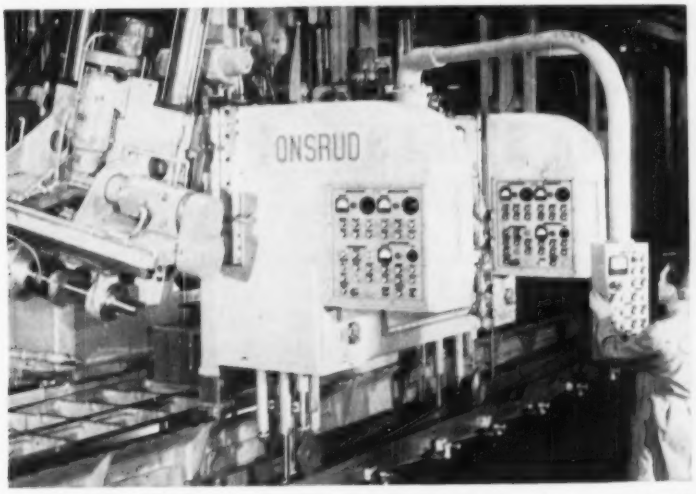
The cost per page for handbooks can range from $50 on simple instruments to as much as $1,000 for complex equipment. Publications executives warn against making estimates solely on a book's size.

A careful review of writing specifications and of the contract helps the estimator to avoid overlooking requirements. The task is often broken down according to the subdivisions of the proposed book, with notes made of the drawings and photographs required for each section, as well as the estimated time to write the text.

Overhead includes such costs as fringe benefits paid to employees, office space, depreciation of assets and salaries to all those who are indirectly required for each illustrator and writer.

To recover overhead costs, the hourly rates charged to the client for men working directly on the job are at least twice and usually several times the men's actual salaries.

Tubes control 90-ton MILLER



ELECTRONIC controls by GE can simultaneously direct up to 12 cutter-feed motions on this 90-ton spar milling machine for aluminum aircraft parts. Onsrud Machine Works will build 18 for the Air Materiel Command. The controls use 224 electron tubes

How to keep informed on the "with what" part of your business

AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information—advertising. You might call it the "with what" type—which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better—save your company money.

Each advertiser is obviously doing his level best to give you helpful information. By showing, through the advertising pages, how his product or service can benefit *you* and *your* company, he is taking *his* most efficient way toward a sale.

Add up all the advertisers and you've got a gold mine of current, on-the-job information. Yours for the reading are a wealth of data and facts on the very latest in products, services, tools . . . product developments, materials, processes, methods.

You, too, have a big stake in the advertising pages. Read them regularly, carefully to keep job-informed on the "with what" part of your business.

McGRAW-HILL PUBLICATIONS

For your immediate use
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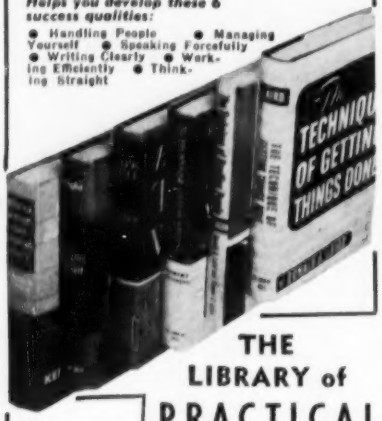
EXECUTIVE SUCCESS

SUCCESSFUL executives will tell you this simple fact: certain *key abilities* practically allow a man to write his own paycheck. And one doesn't have to be born with these proven executive qualities—they *can* be self-developed to a degree you may never have thought possible—easily, and *without* long years of study. You can help yourself acquire them with this specially selected Library of practical executive techniques.

The six books comprising this Library have been selected by successful executives as the ones *most useful* in developing the six qualities of executive success.

Helps you develop these 6 success qualities:

- Handling People
- Managing Yourself
- Speaking Forcefully
- Writing Clearly
- Working Efficiently
- Thinking Straight



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Want more information? Use post card on last page.

Wanted: electronic IDEAS

National Inventors Council searching
Wants answers for 50 military needs
Channels ideas for defense development

OVER 50 military equipment needs that might be answered electronically are on the National Inventors Council's latest list of inventions wanted. Needs range all the way from complete systems to new components.

One of the council's notable successes since its inception in 1940 is the magnetic mine detector, which stemmed from an idea on how to find buried treasure. Some problems, such as miniaturization, are considered largely solved. But among those still outstanding are:

- Wireless transmission and reception of 1,000 watts of power. Low-power destructive rays. Ways of communicating without radio or sound waves. A means of underwater target detection other than sonic.

- Conversion of heat or chemical energy into 100 watts of power. A practical method to analyze odors. A device that will locate buried explosives. A fluxmeter to measure changes in the earth's magnetic field without being fixed in the field.

- Measures to overcome radar jamming. How to get around the earth's curvature effect. How to distinguish between fixed and moving radar targets. Low-power ways to increase radar range. Methods of locating targets in three dimensions, deriving target velocity and maintaining a position track.

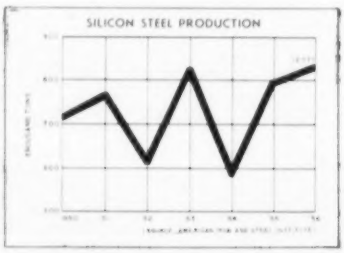
Aircraft: Better instruments to measure supersonic airspeeds, meteorological conditions around the plane and stresses in planes and helicopters; a device to show absolute altitude over unknown terrain, preferably nonradiating; a maneuver restrictor that will prevent the pilot from overstressing the plane, provide for early corrective action and be independent of the plane's center of gravity, and an anoxia warning device to prevent crewmen from collapsing from lack of oxygen.

Silicon STEELS feel the pinch

A CHECK among transformer manufacturers indicates that electrical-grade steel supplies are comfortable except for a few types. None voice the acute distress, current since the beginning of the Suez crisis, of ship plate and structural shape consumers.

As United Transformer sums up the electrical steel situation: silicon steel is tight, grain-oriented silicon steel is tighter and high-nickel steel is tightest. Silicon steels are heavily used in electronic and communication equipment.

Other firms report that the nickel alloys are available only with priority contracts or waits up to three months. Silicon steels generally require a three to four-week delivery period. Other types can be had



directly from the warehousers.

Cycle Transformer reports that, even so, supplies are better than a year ago. It has not heard of a gray market. Langevin Manufacturing's Daniel Ryan points out that the growth of transformer business fostered by growth in electronics is creating the pinch.

Between the 1947 and 1954 censuses, transformer sales went up 91.8 percent. To meet demands, steelmakers have plans for some 20 new furnaces for electrical steel. Allegheny Ludlum estimates that silicon steel production was 830,000 tons in 1956. That is five percent higher than 1955 and over the 1953 peak of 820,000 tons.

1/5 of servicemen can fix COLOR

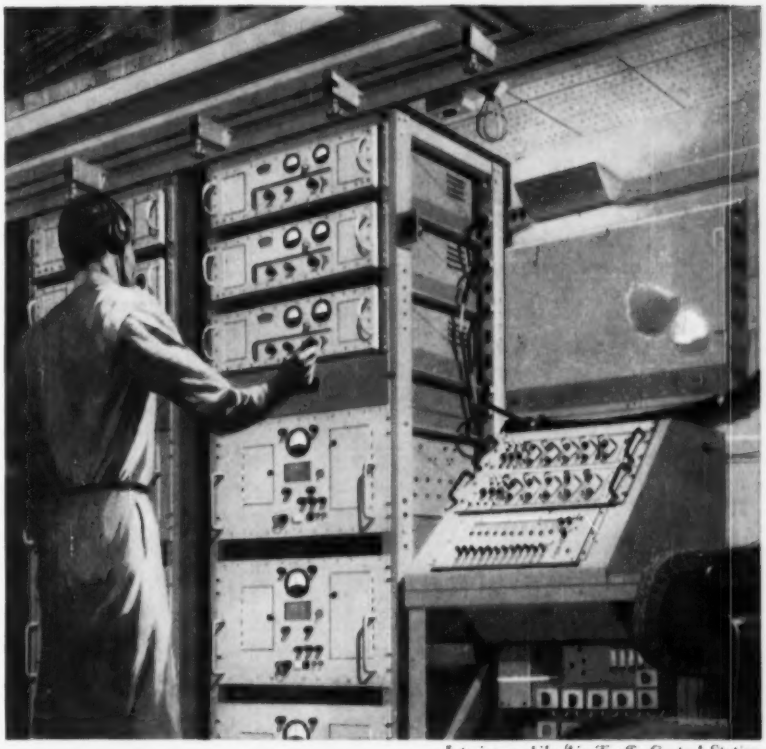
SERVICING color tv sets is not the worry of a year ago for the color tv set makers. Of the more than 100,000 tv servicemen in the country about 20 percent apparently have enough knowledge to tackle a color set.

The policy of almost every color set manufacturer has been to teach. Instruction has taken several forms. Some companies such as Sylvania, GE and Westinghouse have run week-long sessions. Other companies like RCA run lecture series and do-it-yourself workshops where the serviceman works purely on a practical basis.

GE's weekly schedule has been going strong for five months. Of the 400 who up to last week had completed the intensive course, the largest group were independent servicing people. Each man, as in the Sylvania course, teaches when he returns home.

Conrad Odden, RCA manager of commercial service, expects to run twice as many lectures and workshops in 1957 than '56. Last year 360 lectures on theory were given and 450 workshops held. Lectures have proved popular. More than 100,000 people have attended since 1954.

One area in the servicing picture is cloudy. Of the 20 percent assumed to be qualified to repair a color set, less than half have the necessary testing equipment.



Interior, mobile Air Traffic Control Station

NEW from Craig!

STRONGER, *Lighter* RACKS for electronic equipment

Craig is now manufacturing aluminum racks for electronic equipment. Originally designed and developed for use in mobile and air-transportable installations — where high strength and low weight are of primary importance — they have proven so successful, Craig is now offering these racks to industry. They are equally adaptable to fixed installations and are designed to meet military specifications. Here are some of the outstanding features:

Mobile Air Traffic Control Station

ADAPTABLE – accommodates standard 19" wide RMA panels in standard height increments.

RUGGED – box-type construction supports great weights — including heavy power supplies.

HIGH STRENGTH – extruded aluminum uprights, die cast aluminum corners, heat-treated aluminum cross members and runners.

LIGHTWEIGHT – 72" rack weighs less than 29 lbs.

SHOCK ISOLATORS — provision for mounting shock isolators on all four corners, top and bottom.

ASSEMBLY – easy-to-assemble parts shipped complete with hardware — or factory assembled.

DIMENSIONS – standard: 20¼" wide, 17½" deep, 73¼" high. Other sizes available.

FASTENINGS – lock-type nuts with nylon inserts, permanently attached to the uprights, insure solid fastening of panels to rack.

ACCESSORIES – Spare Parts Drawers of various sizes. Standard runners and hardware available from stock. Provision for attaching metal raceway for housing power and signal wiring circuits

Write for brochure giving complete details and prices.

Craig SYSTEMS, INC.

Dept. R-2, DANVERS, MASS., Telephone: SPring 4-1870

VISIT US AT THE I.R.E. SHOW—BOOTH 1325

AF to build RADAR range

Will buy radio, radar, instruments
Project to cost $40 million
Plan to test new aircraft

AIR FORCE plans to make Edwards AFB, California, the nation's foremost aircraft flight-test center call for a $40-million expenditure. Major electronic items in the expansion program are radar instrumentation for a 400-mile radar range in the Mojave Desert and communications to command headquarters at Edwards.

Two contracts for this project have been awarded to date: $1.25 million to Reeves Instrument, a subsidiary of Dynamics Corp. of America for instrumentation radars (MOD-2) scheduled for July delivery, and $1.4 million to Electronic Engineering for electronic research and development work, road construction to mountaintop sites, erection of special buildings and installation of power lines and communications facilities.

Stand-in for ATLAS

TESTS MADE with smaller and cheaper stand-in missiles in place of the actual weapon are enabling the Air Force to obtain guided-missile research data at far less expense. Guidance and control systems and aerodynamic design are effectively tested.

At least four of these guinea-pig missiles are known to be used in developing new weapons. Two of the missiles are recoverable.

• Lockheed's supersonic X-7, used in the development of ramjet ground-to-air missiles, flies higher and faster than some air-defense missiles. Each recovery, which is accomplished by parachute, saves about $350,000.

• North American's X-10, also recoverable, acts as stand-in for the SM-64 Navaho. Powered by two turbojet engines, the X-10, according to North American's J. G. Beerer, has successfully flown hundreds of miles at supersonic speeds.

• The X-17, also built by Lockheed is not recoverable. But even though it is a three-stage ballistic rocket which weighs more than six tons and stands as high as a four-story building, it is still cheaper than a strategic missile.

The X-17 is used to provide information on the problems which arise when the warhead of a ballistic missile—such as the Atlas, Titan or Thor—reenters the earth's atmospher at high speed.

• Aerophysics Development Corp.'s hypersonic test vehicle, the HTV, is said to reach the speed of sound two seconds after being fired. Not recoverable, the HTV costs only $8,000.

Fired from a portable launcher, a two-stage rocket brings the HTV to a speed of Mach 7 at 5,000 feet. Test data equivalent to comparable data for far higher speeds at greater altitudes is provided. A magnetic tape recorder is carried in the nose cone.

MILITARY electronics

Marine landing vessels equipped for remote radio control by Lear perform unmanned amphibious operations "better and faster than is possible manually," says Lear. Similar craft also to be Lear-equipped, are armored assault vessels carrying howitzers. Landings through heavy surf are accomplished with the pilot hovering overhead in a helicopter, or on the mother ship.

Hughes' new air-to-air guided missile, GAR-1D a new version of the Falcon, is said to climb at a speed higher than any other existing armament of its kind. Slightly longer than six feet, with a six-inch diameter, the missile is being manufactured at Hughes' Tucson plant.

ARDC's Air Force Armament Center, Eglin AFB, Fla., is using Sperry Rand's Univac Scientific computer to reduce armament test data and in ballistics research. One problem solved by the computer in 25 minutes would take 32 desk-calculator operators two years to complete.

CONTRACTS awarded

Standard Coil's Kollsman Instrument Corp. was awarded a $26-million Air Force contract for production of an automatic astrocompass. The compass, which will automatically track celestial bodies and compute precise aircraft direction, is the first of a series of automatic navigation equipments being developed by Kollsman for ARDC and the Bureau of Aeronautics.

University of Michigan was awarded a $560,000 Army Signal Supply Agency contract for continued re-

search in the field of electronic measurements.

Ford Instrument was awarded a contract by Air Materiel Command in excess of $15 million for production of automatic dead-reckoning computers, ASN-7. The equipment will be installed in fighters, reconnaissance, bomber and cargo aircraft.

Army Signal Supply Agency, Philadelphia, has bought radio-set keyers amounting to $8,983,538 from Bendix Radio; general purpose oscilloscopes AN/USM-50 from Lavoie Laboratories, Morganville, N. J., $2,132,288; frequency meters, AN/URM-79 from Adler Electronics, New Rochelle, $1,478,852.

Stromberg-Carlson was awarded a $479,991 contract by Air Materiel Command for ARN-32 receivers, radios, antennas and mountings. Stromberg-Carlson was also awarded a $319,750 contract by Navy's Bureau of Ships for amplifiers.

RCA Service Co. was awarded a $1,031,849 contract by Navy's Bureau of Aeronautics for maintenance, repair and operation services of aircraft electrical and electronic equipment.

Decker Aviation was awarded a $207,394 contract by Warner Robins Air Materiel Area for modification and repair of angle of attack computer components.

Collins Radio has received a $19.5 million contract from the Navy Bureau of Aeronautics for airborne multichannel communication equipment in the high-frequency range. The contract covers 2,500 AN/ARC-38 transceiver systems and over 1,100 AN/ARR-41 receivers, as well as antenna couplers, test equipment and accessories. The order includes $3.9 million in spare parts.

Air Materiel Command has contracted RCA for major subassemblies for airborne radio-receiver sets, power supplies and data, amounting to $7,749,473.

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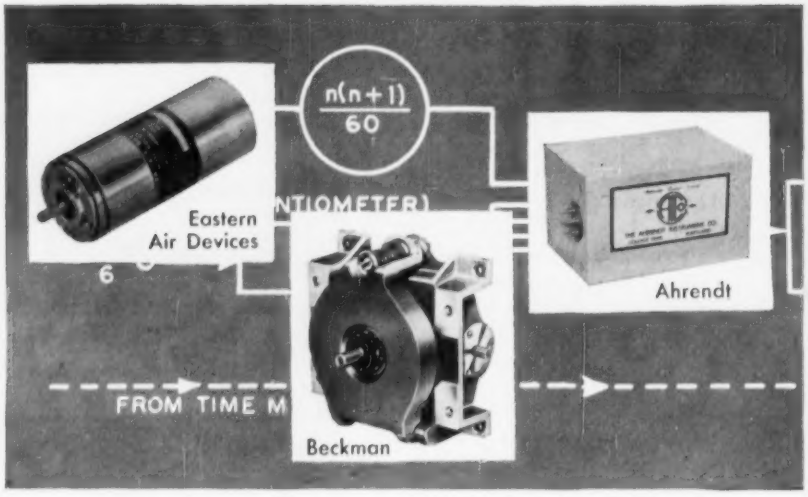


Mechanization of equations in analog computers requires a variety of com-

ANALOG computers are controlling petroleum and chemical processing plants and aiding electronic design engineers to solve problems. Servomotor-tachometer generators for use in analog computers are being produced by **Eastern Air Devices** (P1) with 0.5 percent linearity. Ball-and-disk integrators are announced by **Beckman** (P2).

Ahrendt's (P3) 400-cps magnetic amplifier for computing servo systems is adaptable to inputs from d-c to 1,000 cps with a reference transformer. Gearheads with a variety of ratios are offered by **Feedback Controls** (P4) and **Southwestern** (P5) for computer applications. A rack-mounted array of 10 operational amplifiers with self-contained power supply is available from **Philbrick Research** (P6).

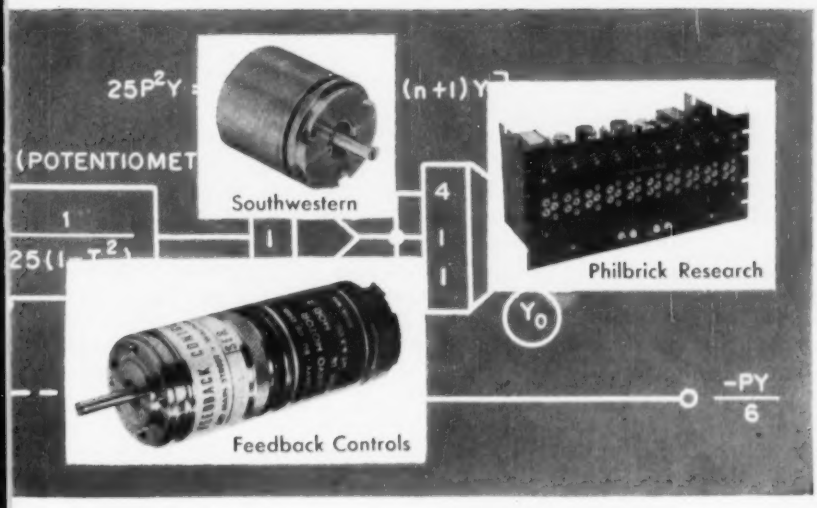
A frequency detector providing an output current linearly proportional to frequencies between 375 and 425 cps is available from **Airpax** (P7) for telemetering, instrumentation and automatic control. . . . A shock mount designed by **Barry Controls** (P8) for mounting heavy electronic equipment in aircraft and missiles is said to provide damping in all directions. . . . Called the Amprobe, a volt-ammeter by **Pyramid Instrument** (P9) can measure current without cutting conductors and can be used for balancing circuits and tracing faults.

A water-sealed insulated splice called Sealink has been developed by **Omator** (P10) to accommodate AN wire sizes from 26 through 10. . . . **Narda's** (P11) 10-db coaxial directional couplers cover the range from 225 to 4,000 mc. . . . A transistor curve tracer by **Cubic** (P12) is used with an oscilloscope to provide an eight-family or single-curve presentation of dynamic output characteristics of transistors for grounded-emitter operation.

Instrumentation tape recorders designed by **Ampex** (P13) can record and reproduce up to seven tracks of data at four tape speeds and has plug-in amplifiers for direct, frequency-modulated and pulse-width modulated recording. . . . A screen room by **Erik A. Lindgren and Associates** (P14) is said to provide at least 100 db attenuation in the frequency range between 200 kc and 1,000 mc.

A line of all-semiconductor power supplies designed by **Electronic Research** (P15) delivers up to 12

NEW PRODUCTS



ponents such as these to perform mathematical operations.

amperes with adjustable outputs from 6 to 32 volts d-c. . . . **Research Laboratories** (P 16) announces tubular metal-cased capacitors said to have processed Teflon dielectric material that assures exceptionally high performance up to 200 C without derating. . . . Loran receivers designed for aircraft by **Edo** (P 17) for operation at 1,750, 1,850, 1,900 and 1,950 kc weigh only 26 pounds.

An amplifier designed by **Beva Laboratory** (P 18) for scintillation and proportional counters is said to trigger reliably at 1.5 mc. . . . The 6AW8A and 6BA8A 9-pin triodes announced by **Sylvania** (P 19) for black and white and color tv receivers have 600-ma heaters for series heater strings. . . . Electronic smoke indicators and recorders announced by **Brooke Engineering** (P 20) use photoelectric cells to determine smoke density.

Gilmore's (P 21) digital indicator is said to furnish high-resolution readings from voltage and resistance changes developed by flow, weight and temperature transducers. . . . **George Stevens Manufacturing** (P 22) is producing direct-drive high-speed hand-fed coil winders for solenoid and bobbin coils. . . . Miniaturizing of magnetic designs is said to be possible with **Polymer's** (P 23) Ferrotron, a flexible ferromagnetic plastic in rod or tape form.

Humphrey (P 24) offers 30,000-ohm potentiometers said to withstand severe environmental conditions. . . . Designed for aircraft use, **United Transformers'** (P 25) variable autotransformers operate on 115 volts, 400 cycles and have an output from zero to 28 volts. . . . Broadband floating-input d-c amplifiers are offered by **Kay Lab** (P 26) for use with thermocouples, strain gages and other devices that are grounded at the transducer location.

Varian Associates' (P 27) VA-806 klystron provides 2,000 watts continuous power in the frequency range between 7,125 and 8,500 mc. . . . Using four vacuum tubes, **Applied Research** (P 28) has developed a uhf to vhf converter with an overall gain of 25 db. . . . Em-

For more information circle numbers in SECTION B, READER SERVICE CARD (facing p 48)

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erson & Cuming (P 29) announce Stycast 1090, an epoxide resin of extremely low weight for encapsulating electronic assemblies.

Portable x-ray equipment available from **Holgar Andreasen** (P 30) is said to locate internal corrosion in sealed welded tubing and can be used for aircraft inspection. . . . **Richardson-Allen** (P 31) offers a 400-cps power supply that delivers from 6 to 9 volts at from zero to 50 amperes as a filament and relay power source. . . . Pushbutton operation and a drift-free amplifier are featured in **Beckman's** (P 32) pH meter.

An electric furnace is announced by **BTU Engineering** (P 33) for alloying, brazing and soldering semiconductor products. . . . Thin and wide-line ball-point pens are available from **American Industrial Electronics** (P 34) for use in strip chart recorders. . . . Interchangeable tuning units are used in **Polarad's** (P 35) microwave generators to cover the frequency range from 18,000 to 50,000 mc for field, laboratory or production line testing of microwave equipment.

Setscrews in sizes 0, 1, 2 and 3 are available from **Set Screw** (P 36) in socket, socket cap and slotted styles for miniaturized electronic and electromechanical equipment. . . . Colored epoxy resins by **Furane Plastics** (P 37) are said to provide an indication of the completeness of mixing, as well as a means for color coding potted electronic units.

Phaostron (P 38) announces basic meter movements with newly designed core magnets said to assure good linearity over 100 degrees of scale arc. . . . A line of knobs for electronic apparatus by **Cambridge Thermionic** (P 39) are available with or without skirts. . . . A temperature test chamber developed by **Statham Development** (P 40) has a capacity of 600 cubic inches and a temperature range from −65 to 600 F.

Called the Corro-Dex, **Labline's** (P41) transistorized corrosion meter measures corrosion layers as thin as 0.000001-inch. . . . A revised line of wire-wound silicone-sealed resistors announced by **Dalohm** (P42) are available in power ratings of 2, 3, 5, 7 and 10 watts. **Alpha Metals** (P 43) announces a quick-drying flux coat to protect printed-circuit boards from corrosion during storage.

Improved Unidyne microphones, available from **Shure Brothers** (P 44) for low-gain public address systems and tape recorders, are said to provide 41 percent higher output. . . . Plug-in relays with contact arrangements up to dpdt are available from **Line Electric** (P 45) with silver contacts rated at 10 amps for 115 volts a-c.

Printed-circuit coils designed for horizontal mounting are available from **Cambridge Thermionic** (P 46) in lengths of $\frac{3}{8}$ and $\frac{13}{16}$ inch. . . . Choppers available from **James Vibrapower** (P 47) are capable of frequency doubling or providing two outputs 90 degrees apart. . . . **DeJur-Amsco** (P 48) announces solderless terminal blocks said to provide positive locking between taper pin and machined-tapered receptacle.

Entron's (P 49) vhf band-rejection filters are claimed to provide extreme stability, sharp cutoff and a wide tunning range for improving band-edge response of broadband filters and amplifiers. . . . Manufactured by **Radial Cutter** (P 50), fine-pitch carbide-tipped circular saw blades have been designed for cutting thermoplastic materials and printed-circuit boards.

Quantities measurable by differential transformer transducers, such as size, weight, pressure or acceleration, can be controlled with **Daytronic's** (P 51) limit controller, said to be stable within 0.1 percent of transducer span. . . . **Toledo Scale** (P 52) announces a weight data system that originates, transmits and computes weights for remote recording.

Practically infinite life is claimed for Teflon-bodied beryllium-copper test-point jacks made by **Sealectro** (P 53). . . . Insulated ceramic terminals announced by **Cambridge Thermionic** (P 54) are only $\frac{1}{4}$ inch in diameter and about $\frac{3}{8}$ inch high when mounted. . . . **Borg Equipment** (P 55) claims extreme accuracy, fine resolution and low torque for their Micropot single-turn 10,000-ohm potentiometers.

E and I $\frac{7}{16}$-inch transformer laminations are available from **Temple Manufacturing** (P 56) for making miniature audio interstage and out-

Punched cards run LATHE

NUMERICAL positioning control by GE, containing some 50 tubes, operates a Sundstrand lathe. Control programs directly from drawings to punched cards. Machine set-up time is reduced 80 percent.

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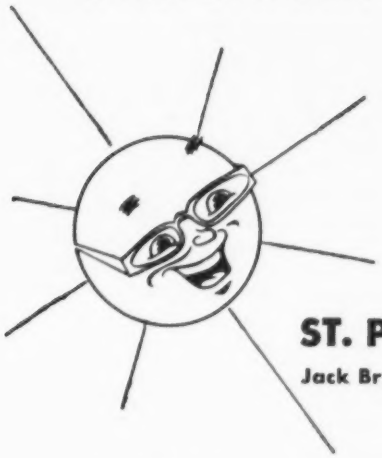

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put transformers. . . . **Southern Engineering's** (P 57) transistorized load indicator has been designed for resistance-bridge electronic weighing, pressure measurement and strain indication. . . . Vinyl, nylon and polyethelene insulation can be stripped without cutting or nicking wire with **Western Electronic Products'** (P 58) hot wire stripper using a heated nichrome filament.

Video jack panels are designed by **Nems-Clarke** (P 59) to provide coaxial patching facilities for tv and other applications where 70-ohm lines are used. . . . **W. H. Nichols** (P 60) offers high-speed automatic milling machines suitable for slicing and dicing germanium ingots for transistor manufacturing.

Designed to operate on 400 cycles, **Graham Transmissions'** (P 61) continuously variable speed drives for use in testing tachometers, gyros and accelerometers are available with speeds as high as 10,000 rpm. . . . Copper-cored sealing alloy wire made by **Metals and Controls** (P 62) is said to provide better conductivity with the same diameter wire for hermetically sealed relays, coils, transformers and terminal blocks.

A motor-operated time-delay switch developed by **Globe Industries** (P 63) provides delays from 15 to 30 seconds and 5 single-pole double-throw switching functions. . . . **Deltime's** (P 64) delay lines with ten pickup coils operate in the range between 2 and 40 microseconds and furnish ten continuously adjustable outputs.

Miniaturized slip rings are being produced by **Poly-Scientific** (P 65) for use in vertical gyros to detect aircraft pitch and bank. . . . An interference meter announced by **Interference Testing and Research** (P 66) operates between 75 kc and 35 mc or in any of 4 selected bands in that range. . . . A tube socket developed by **Jettron** (P 67) features low capacitance between cathode and grid contacts and between grid and anode contacts for uhf amplifier service with the 6BY4 tube.

61 tv TRANSLATORS in works

Idea grows with local backing
1,000 seen in three years
Boosters still FCC problem

SMALL population areas, beyond the reach of tv stations because of mountains or distance, are finally being helped by the FCC. Pressure was heavy for a solution.

The main pressure applied to the Commission was, in its own way, a solution. Reradiating r-f amplifiers, called boosters, provided an unhappy way out from the FCC's viewpoint. Begun and operated without FCC permission, some continue to operate after being banned.

There are, however, now two Commission-sponsored methods to give remote or isolated communities the tv reception they want. These are satellites and translators.

• Boosters do just what the name implies. The original signal is picked up by an antenna, amplified and reradiated on its original frequency to reach the area that wants it. Boosters have sprung up principally in the Pacific Northwest.

• Satellites operate on channels already allocated to the community but unused, often because the community can't support a regular tv station. As satellites, they are owned and operated by a tv station seeking a larger audience. The mother station supplies programming. Satellites must meet all the technical requirements of any tv station.

• Translators do essentially the same thing as boosters, but the signal is converted to uhf before being reradiated.

Boosters still exist. But three are in hearing before the FCC. One is in court trying to get the illegal tag changed to legal.

Translators are beginning to blossom. Since last September 14 have gone on the air. Eleven more have been authorized and 36 are pending.

Adler Electronics manufactures a 10-watt translator. Its president, Ben Adler, says he has shipped more than 50. He thinks the buyers are warehousing in anticipation of construction permits. He has commitments for 50 more units; sees 1,000 translators in three years.

FCC issues tv list

FCC HAS REVISED its Radio Equipment List of transmitters, translators and monitors acceptable for tv broadcasting use. Type acceptance is required for listing of transmitters, type approval for translators and monitors.

GE has two new transmitters on the list, making a total of three. RCA has six type-accepted transmitters listed. There is a type-approved monitor, manufactured by Beckman Instruments. A type-approved translator is made by Adler Electronics.

MOTOROLA plans merger a year

SINCE December 1 Motorola has been impressively interested in mergers. Richard S. Frazer has been placed in charge of the New Business Interest Department. He devotes most of his time to finding companies to merge with Motorola.

"We would like to get bigger in industrial, military and commercial," says Frazer. "We want companies of $4-million size with a sales potential of $5 million."

The intention is to exchange stock. At present market value Motorola has available $40 million in unissued stock. The object is not to integrate a company.

Motorola's plan is to merge at the rate of one company a year.

FCC actions

A-M construction permits were granted to Southwest Alabama Broadcasting for Bay Minette, Ala.; Sunshine State Broadcasting for Bradenton, Fla.; and S. L. Goodman for Danville, Va.

Cortland, N. Y. loses channel 56 to Binghamton, N. Y. and gains channel 72.

Congressional interest in the FCC promises to be high in 1957. Criticism has already been leveled in a majority report from the House Small Business subcommittee. It charged that the FCC fails to protect the small businessman in the communications industry.

Commission funds under the federal budget call for an increase of $1,122,000 for a total of $8,950,000. Reason: "To meet problems resulting from advances in technology and expanding use of radio-tv."

Big-city vhf decisions are being given priority by the Commission. Boston's channel 5, Indianapolis' channel 13, St. Louis' channel 11, Seattle's channel 7 are all being hotly contended for.

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SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

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STATION moves and plans

Time, Inc. acquires the Bitner tv-radio stations in Indianapolis, Grand Rapids and Minneapolis. The company, Consolidated TV & Radio Broadcasters, goes for $15,750,000 cash.

As a further move, the publishing house's tv-radio station KOB, Albuquerque, N. M., goes to KSTP, Inc. for $1.5 million.

KARD-TV, Wichita, Kansas, has completed its $1-million plant. An NBC affiliate, it is fully equipped for color.

New transmitters are being installed by WGRD, Grand Rapids, Mich.; WAKN, Aiken, S. C.; WRAP, Norfolk, Va., and KONO-TV, San Antonio, Tex.

San Luis Valley Broadcasting Co. changes its name to Colorado Radio Corp. It owns KSLV, Monte Vista, Colo. and KUOD, Denver, Colo.

H. & E. Balaban Corp. expands its broadcasting holdings by buying an interest in KFBI, Wichita, Kans. It already has its fingers in four uhf-tv stations: WTVO, Rockford, Ill., WICS, Springfield, Ill. WMCN, Grand Rapids, Mich. and a construction permit for a new station in Birmingham, Ala.

KGON, Portland-Oregon City, Ore. is now affiliated with the NBC Radio Network. ABC picks up the former NBC station KGW as well as KGW-TV as affiliates.

Baltimore's three tv stations WAAM, WBAL-TV, and WMAR-TV are planning to put up a 735-foot tower to support all three transmitting antennas.

WIBW and WIBW-TV, Topeka, Kan. have been purchased by Stauffer Publications, Inc. from the Arthur Capper estate. The price was $2,498,675.

GOLDEN GATE attracts

Electronics likes San Francisco area
30 firms employ 15,000
Sell $400 million annually

BRAIN POWER, an attractive climate and opportunities for the good life are location advantages which are building the San Francisco Bay area electronics industry. These findings were reported in a study by G. Langdon White and Ronald L. Chatham of Stanford University.

There are some 30 electronics firms with more than 15,000 employees in this area, comprising the nine counties adjacent to the Bay. The annual value of electronic products is about $400 million. The four largest electronics firms each employ between 1,200 and 3,000.

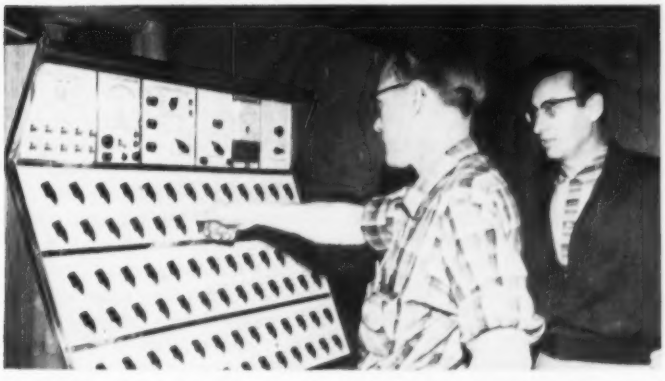
With locally available brain power as a prime advantage, most of the firms are active in research. The Bay area is also one of the world's largest manufacturing areas for transmitting tubes. Its instrument production, combined with Southern California's, represents much of the nation's output in this field.

Prime source of the area's brain power is its schools. It boasts an unusually high proportion of technically educated citizens. The University of California and Stanford University are located here.

A large proportion of engineers who graduate from Bay schools make the area their permanent home. The area's mild all-year climate is said to provide almost ideal working conditions.

Within the past year a dozen firms have announced expansion plans. IBM is building a multimillion-dollar plant covering 400,000 sq ft, while Lockheed plans to spend $20 million in the area in the next three years.

Cuts TESTING time



THERE are 750 wiring circuits for electronic equipment in the nose of an F101. Hand testing the circuits would take 20 hours, but Beech Aircraft does it in one hour with this tester. It contains electron tubes in a leakage-measuring unit.

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THYRATRONS to rise 50%

Industrial tubes gross $5 million in 1956
Hydrogen thyratrons gross $3 million
Trend is to ceramic hydrogen thyratrons

DEMAND by industry for thyratrons, exclusive of hydrogen thyratrons, is expected to increase during the next five years 50 percent over last year's $5-million gross. One reason: the trend toward wider use of industrial control equipment. The build-up of thyratron sales should be steady.

Known as grid-controlled rectifiers, these mercury-vapor or xenon-filled tubes serve as stepless controls that require little operating power. They are used as electronic switches to close and open circuits at high speeds, as rectifiers to change a-c to d-c, as inverters to change d-c to a-c and to perform many other operations in industrial control circuits.

Hydrogen-thyratron production, almost 80 percent of which depends on military needs, is more difficult to forecast. A large stockpile was accumulated by the government last year.

Overall prospects for hydrogen thyratrons are good. 1956 sales were estimated at from $2.5 to $3 million. One large manufacturer predicts that total industry sales will double during the next five years. Another producer expects that due to renewed government activity his company will increase sales by 40 to 50 percent this year.

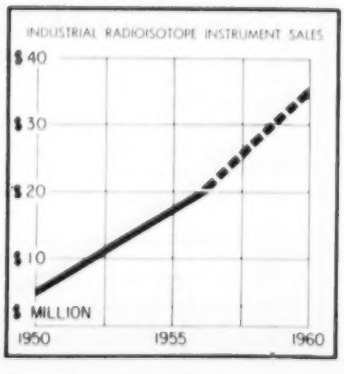
Hydrogen thyratrons handling less than two megawatts are used in weather, anticollision, airborne and antiaircraft gun-laying radar. Tubes two megawatts and over go into early warning and large gun-laying radars. Large hydrogen thyratrons are used in directing equipment for missiles.

Airport landing-control radar and atomic-energy equipment use hydrogen thyratrons both under and over two megawatts.

Some design trends aim at replacing the tube's glass envelope with ceramics. Reason: need for weight and size reduction plus greater shock, vibration and ambient temperature resistance. Ceramic hydrogen thyratrons will also handle higher powers.

It is not expected that ceramics will supersede glass in all hydrogen thyratrons. Ceramics will be used where performance specifications are most rigid.

ISOTOPES sell $20 million



SALES of electronic equipment associated with industrial and research uses of radioisotopes reached $20 million in 1956, according to Robert Butenhoff, chief of the radiation instruments branch of AEC.

Butenhoff estimated 1950 sales at $5 million and 1954, $15 million. He expected the rate of climb to continue with $35 million being reached in 1960.

An estimated 100 companies are presently engaged in manufacturing nuclear instruments. The Atomic Industrial Forum reports 134 firms joined users in 1956, for a total of 1,121 firms with 1,517 installations. Applications were in research, instrumentation, metals, paper, plastics, chemicals, oils and machinery manufacture.

The best measure of market prospects has been the impact of radioisotopes on industry. Reports place annual industrial savings achieved through their use at $100 million in 1954 and up to $200 million in 1956. Savings may rise to $1 billion by 1965, according to *Nucleonics*.

Radioisotope applications dependent on electronic equipment include measuring density of liquids and slurries in a container or pipe, gaging thickness of continuous strip materials and tracing materials through processing, medical and agricultural analysis.

Tracer studies require a nuclear source, detector, amplifier, recording instruments and servomechanisms.

RUSSIAN educators boast of more grads

RUSSIA graduates 75,000 engineers of all types annually, including 5,000 instrumentation and control engineers.

That was the sobering report brought home from a recent international meeting of instrumentation experts in Heidelberg, Germany, by David M. Boyd, Jr., who heard the boast from three Russian educators. Boyd is the head of the instrument department of Universal Oil Products Co., Des Plaines, Ill.

"Instrumentation is essential to controlling nuclear processes and guiding rockets," Boyd comments. "And Russia appears to be training all the instrument experts it needs."

The Russians were faculty members of the Institute of Automatics and Telemechanics of the USSR Academy of Sciences in Moscow. They said Russia has 120 professorships of control engineering alone.

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FINLAND'S industry falls behind

Treaty ties Finland to Russia
Reds give little help
Finns lag both East & West

FINLAND HAS only the germ of an electronics industry. Although Finland has a treaty of technical, scientific and cultural cooperation with the Soviet Union, she has benefitted little in electronics. That is the opinion of several eminent Finnish scientists.

Television sets are being made only on an experimental scale in Finland, where there is no regular transmission of tv. One group of scientists is bending its efforts towards the completion of a small computer in May, largely through team efforts with German scientists.

One Finnish scientist commented sadly: "It would be better to write nothing about Finland's electronics industry. There isn't one."

One of many Finnish scientists who has visited Russian technical establishments declared:

"If only we could have direct man-to-man, scientist-to-scientist contact with the Soviets, I am sure the cooperation would be more profitable."

The scientist said he believed the Russians were well advanced in many areas of electronics. A Beta-spectrograph for measuring the energy of electrons from nuclei that he saw in Leningrad was one of the finest instruments of its kind in the world, he asserted. Photoconductive devices of an advanced nature that he did not see on a trip to the United States were shown in Leningrad.

HUNGARY tells of tv

HUNGARY'S nationalized Orion Electric Appliance and Tube Factory in Budapest has reportedly manufactured 2,000 tv sets since production started one and a half years ago.

A Budapest report predicted output would drop in the next year and a half because of reconstruction of the Hungarian economy following the October rebellion. Total investment in Hungary's tv industry now amounts to about $2.58 million.

Developments ABROAD

Italy has a new $2.5 million plant for the manufacture of electron tubes and instruments. The plant, Electronica Sicula, was opened in Villagrazia, Palermo by the Italian Ministry of Foreign Trade. It was financed by the Sicilian government and by private Italian and American investors.

In Borneo processed crude oil is now loaded into tankers three and a half miles off the coast of Sarawak by radio controls. Britain's General Electric and Royal Dutch Shell solved the engineering problems.

A portable transmitter-receiver is put aboard an incoming tanker. This provides communications with the shore terminal as well as a pump-control channel. Pressing a control button on the set stops the pumps on shore.

In London the BBC recently put its new television studios into operation with equipment supplied by Marconi's Wireless Telegraph Co. including 10 camera channels, video mixers of a new type and a considerable amount of auxiliary equipment.

In India a new 20-kw medium-wave transmitter has been put into service by the Government-owned All-India Radio in Trichur, a trade center in the south of India. The Government's second five-year plan provides $19 million for expansion of broadcasting facilities. More medium-wave transmitters will be added.

Britain's acute manpower problem may take a curious turn. Big electronics firms are said to be interested in bidding for women engineers. The director of one group says that if a woman degree holder who has left engineering is anxious to resume her career, he's prepared to offer her a six-months retraining program to bring her up-to-date.

Scottish commercial television will start Aug. 31 after five months of exhibition to allow the Scottish public to see the type of programs it may expect commercially. In May the Radio Industries' Council will hold its first Scottish exhibition since before World War II and exhibitors will display the trial commercial tv programs.

By the time commercial tv is on the air in Scotland, it is estimated that there will be a half million tv sets. Scottish Television, the contractor for the tv service, will have headquarters and studios in Glasgow.

EMI Electronics of Britain is studying the possibility of providing an analog computer system to handle automatically the rubber-mixing of a large rubber company.

EXPORTS and IMPORTS

American radio and television exports for the first nine months of 1956 amounted to $199 million, according to statistics released by the Department of Commerce. The figure for the corresponding period in 1955 was $152 million.

Export value of scientific and professional instruments rose from $49.4 million in the first nine months of 1955 to $60.8 million in the same period last year. The total for electrical apparatus jumped from $627.3 to $770.3 million.

Ceylon's government wants to establish an education and information program using radio receivers in rural areas. It will set up a radio-assembly industry to supply low-cost receivers and will import components. Duties on radio parts have been lowered.

West Germany's production and sales of tv sets in 1956 amounted to 600,000 sets, compared with 350,000 in 1955. About 550,000 were sold on the domestic market and 50,000 exported in 1956.

Industry sources said 3,300,000 radio sets were sold in 1956, about the same number in 1955. Home market sales fell from two-million sets in 1955 to 1.7 million in 1956, but this decline was made up by exports which rose from 1.3 to 1.6 million sets.

In Brazil Emerson Radio Export Corp. has purchased land at Bello Horizonte, 100 miles from Rio de Janeiro, to erect a plant that will manufacture commercial electronics equipment. The plant is expected to have its own locally staffed research and development organization.

In Rio itself an Emerson plant began operating last October to produce tv receivers, radios, phonographs and components. It was built by Emerson's licensee distributor, Industrias Reunidas Max Wolfson S. A., and employs more than 200.

Brunei, on the northwest coast of Borneo, will get its first broadcasting station, to be installed by Marconi's Wireless Telegraph Co.

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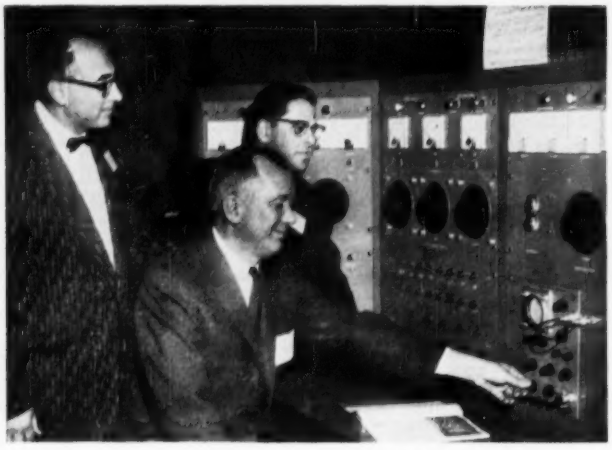

PALO ALTO mayor Noel Porter twirls Tektronix at Levinthal dedication. Watching: A. J. Morris, Levinthal v-p, and Elliott Levinthal

CALIFORNIA plants booming

MORE EXPANSIONS are going forward in California's booming bay area. Levinthal Electric Products, maker of microwave transmitters and equipment for medical research, now has in operation a 12,000-sq ft plant in Palo Alto's Stanford Industrial Park. New plant has twice the capacity of Levinthal's Redwood City location.

Now under construction in the Park is a 126,000-sq ft electron tube plant which will contain all the activities of Varian Associates' San Carlos plant. Varian will move 600 San Carlos employees to Palo Alto. When completed in August, the plant will give Varian 280,000 sq ft of space in the Park, more than half the 500,000 sq ft planned for the company's 33-acre site there.

IT&T's Federal Telecommunications has a new laboratory facility in Palo Alto. On the occasion of the opening, Federal invited half a hundred oldtimers to renew acquaintance with Grand Old Man Lee de Forest, onetime Federal engineer.

Sylvania is building an 18,000-sq ft addition to its microwave tube lab in Mountain View. Eyeing the mushrooming industrial growth on the peninsula, the company has bought 13.5 more acres against the future, will keep it in strawberries until it's needed.

New president at RCA

TAKING OVER RCA's presidential office next Friday is management expert John L. Burns (see cover). "Intimately associated" with RCA for the last ten years, he goes to his new job "without preconceptions."

"I like the excitement of industry," he says, recounting his stay at Republic Steel from 1934 to 1941. He left Republic to become a partner in the management consultant firm of Booz, Allen & Hamilton. When Frank Folsom asked the late Edward Booz to look RCA over, it was Burns who did the investigating and recommending. Now he inherits his own administration.

"I went through a lot of soul-searching," he admits, "before I took the job." Ultimately it was "the challenge in the picture" and the opportunity to investigate the "variety of things to which electronics can be adapted," that swayed him.

Burns, born in Watertown, Mass., in 1908, was graduated from Northeastern with a BS in electrical engineering. He almost stayed in the academic world (he still sits on the board of the Air University and several other schools). While a graduate student at Harvard, he became an assistant in the school of metallurgy there, then served for a year as assistant professor of metallurgy at Lehigh. "They had me teaching the chemical end of it, too," he says, pointing out that the physics of metals was his forte. That and a desire to get some practical training made him quit Lehigh in 1934 and go to work as a laborer for Republic.

While waiting for the new president, RCA has been busy shuffling its second- and third-level management. Douglas H. Ewing moves up to become vice president for research and engineering. Into his old job as general manager of the Laboratories division moves James Hillier. George H. Brown steps into Hillier's slot as chief engineer of commercial electronic products. Engineer Allen A. Barco fills Brown's former job as director of the systems research lab.

New assistant director of research is Humboldt W. Leverenz, with

MEETINGS

Feb. 26-28: Western Joint Computer Conference, Hotel Statler, L.A.

Mar. 11-14: 1957 Nuclear Congress, Convention Hall, Philadelphia. Papers on instrumentation March 13-14.

Mar. 18-21: IRE National Meeting, Waldorf-Astoria Hotel and Coliseum, New York. Also: First Military Automation Exposition, N. Y. Trades Show Building.

Mar. 18-22: AMA Seminar on creative research and engineering, Sheraton-Astor Hotel, N.Y.

physicist Rolf W. Peters moving up as director of the physical and chemical research laboratory. Robert W. Sears becomes plant manager of the television plant in Indianapolis, pulling Raymond J. Riggs into his old job managing the cabinet factory in Monticello, Ind.

The corporation is also establishing a special systems and development department to meet planning requirements of its defense electronics division. C. B. Jolliffe, vice president and technical director of RCA, heads the new department.

WEATHER tests possible as . . .

ADT uses new outdoor test ground

American District Telegraph now tests its electronic protection equipment in a new laboratory and outdoor testing ground in New Jersey.

The outdoor facility, on a 20-acre site near Hackettstown, permits all-weather testing of transmission lines and case-work materials, and the measurement of temperature effects on electronic gear used out-of-doors. Laboratory facilities and living quarters for the engineering staff are included.

Managing the laboratory is F. C. Evans, assisted by chief engineer Maxwell H. A. Lindsay.

The lab technician in the picture is adjusting the controls on a fence which detects intrusion into an electromagnetic field. The fence does not require direct physical contact. Also being tested at the new facility are radiant-heat detectors for use in outdoor fire alarms and microwave systems for intrusion alarms.

Executive MOVES

Two IT&T subsidiaries have new presidents. **Francis H. Lanahan,** onetime chief signal officer for SHAPE, moves up from exec v-p of Federal Electric to the top slot. **Stanley Luke,** an assistant v-p of the parent corporation, moves in to take charge of International Telephone Building Corp.

Maurice R. Eastin moves from General Controls' Prefex division to become general sales manager of Brush Electronics.

ACF Industries' board elects former programming director **Roland S. Tremble** to the comptroller's job. ACF's Avion division meanwhile hires A-bomb engineer **Andrew A. Nargizian** away from Ford, Bacon & Davis, makes him assistant to the president and missile-systems troubleshooter.

Bendix Aviation moves **Lewis F. Millett** up to head the radar development department of its research labs. . . . **Albert W. Brandmaier** now heads the Washington district office of Consolidated Electrodynamics.

John Lesser, former v-p and general manager of Photo Chemical Products of California, joins with metals expert **Daniel S. Karp** in new management consultant firm of Karp, Lesser & Co.

GE is setting up an advanced semiconductor lab in Syracuse, moves **Harris M. Sullivan** from the post of electronics lab manager to head the new facility. The company's Owensboro, Ky., tube plant gets a new manager as **Randolph M. Duncan** moves up.

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Southern REPS' sales up

THE SOUTH generally—and Florida particularly—deserve more attention from manufacturers and their reps, says **Arthur H. Lynch** of Fort Myers, Fla. Lynch, who went South nine years ago to retire and stayed to work, says there's a modest lode of gold in the Sunshine State, with more coming as industries move to warmer country. Lynch's sales for 1956 were up more than 50 percent from 1955.

Patrick AFB has become a major buyer of electronic gear, not to mention the ten or so major aircraft and electronics manufacturers surrounding the base. Florida has two dozen million-dollar industries that weren't there five years ago, and half a dozen more will build there this year.

New rep organization in New York is **M & N Associates**, formed by Robert J. Marcy and Fred J. Neidig. Both men used to be with Langevin Mfg., division of W. L. Maxson Corp. First appointment: Langevin's line of iron-core components and audio equipment.

North American Instruments, Altadena, Calif., manufacturer of aircraft and missile electronics gear, now has nine reps covering the country, with "at least five more" coming shortly. Four recent appointments: **Rush Drake,** Seattle; **Allen I. Williams,** Denver and Albuquerque; **Engineering Services,** St. Louis and Kansas City; **Norvell Associates,** Dallas.

Philco will merchandise its paging equipment and industrial tv through a network of 50 reps. First two to get the nod are **George Voron,** Philadelphia and **Cary Chapman,** Atlanta.

DISTRIBUTORS told to raise prices

DISTRIBUTORS cannot expand to keep pace with industry growth unless they charge more realistic prices, warns Sylvania merchandising manager George C. Isham. If profits are not adequate to finance expansion, the distributor will be forced either to borrow from manufacturers or fold up shop.

Isham gave distributors attending an NEDA seminar an example: he said that 20-30 percent of most distributors' gross income comes from receiving tubes, and that these are frequently sold "on a nonprofit basis."

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About our TECHNICAL edition . . .

Helpful in weather studies, measurement of corona current from a point at the top of a flagpole is usually done in rough weather. How to do it in dry weather when corona current is extremely minute is explained by Hendrick, Martin and Chapman of Cornell Aeronautical Lab in our March 1 issue. Corona point is made radioactive.

How to broadcast two complementary colors from a tv transmitter using black-and-white slides is explained in the March 1 edition of ELECTRONICS by Ed Covington of KVOO-TV. Circuits also permit transmission of a yellow-green color stripe during monochrome broadcasts.

A null detector, described by Todd of GE in the Feb. 1 edition of ELECTRONICS, uses inexpensive transistors in its four-stage amplifier. By measuring the relative magnitudes of a-c signals, the unit can be used for balancing a-c impedance bridges, aligning receivers and checking filter-circuit performance.

A pickup system for commercial color tv can be made at relatively low cost, according to Harold Mate of DuMont. He explains in our Feb. 1 edition how a scene can be scanned by a spot of light and reflected to appropriately filtered photocells to produce color tv signals.

THE EDITORS

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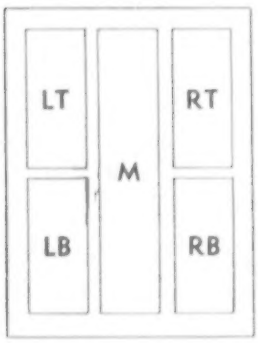

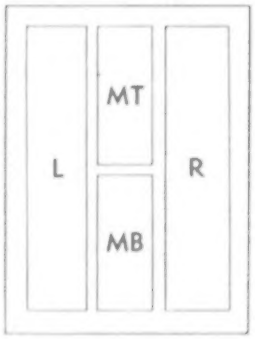

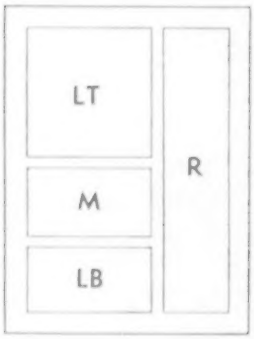

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USE THIS KEY:

R—Right

RT—Right Top

RB—Right Bottom

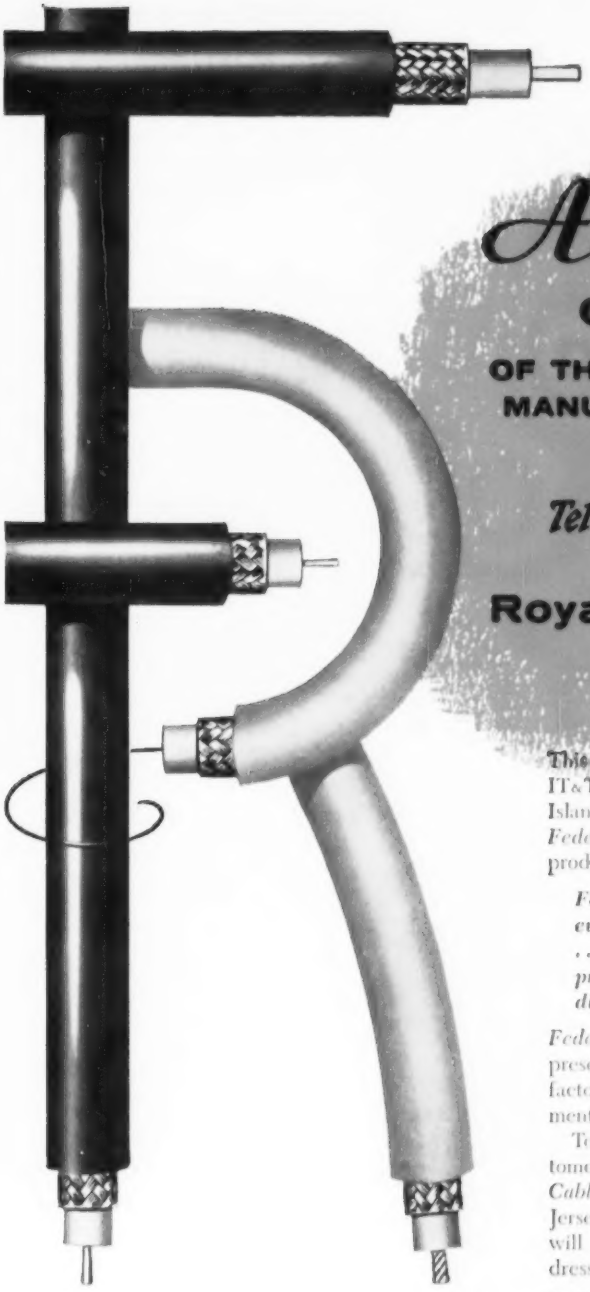
L—Left

LT—Left Top

LB—Left Bottom

M—Middle

MT—Middle Top



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For good electrical contact and excellent thermal conductivity to the heat sink, RCA-2N301 and 2N301-A utilize a special mount structure in which the collector is electrically and thermally connected to a mounting flange.

Among the outstanding design features are: high gain · high alpha cutoff frequency · low thermal resistance · low leakage and low saturation currents · excellent current gain linearity over the full range of the collector current · high operating stability · excellent electrical uniformity.

TECHNICAL DATA—MAX. RATINGS (ABSOLUTE VALUES)		
	2N301	2N301-A
Collector-to-Base Voltage		
DC (for inductive load)	-20 max.	-30 max. volts
Peak	-40 max.	-60 max. volts
Dissipation (mounting flange temp. 55°C)	12 max.	12 max. watts

TYPICAL OPERATION FOR 2N301 & 2N301-A (AMBIENT TEMP. 55°C)		
	CLASS A	CLASS B
DC Supply Voltage	-14.4	-14.4 volts
Max.-Sig. Power Output	2.7	12 watts
Power Gain	32.5 db	30 db
Circuit Efficiency	47%	67%
Total Harmonic Dist.	10%	10% max.

CHARACTERISTICS AT MOUNT. FLANGE TEMP. 25°C	
DC Collector-to-Emitter Voltage	-1.5 volts
DC Collector Current	-1.0 am
Large-Signal DC Current Transfer Ratio	70

Your RCA Field Representative will be glad to di cuss the many advantages offered by RCA Pow Transistors for your specific designs. Contact him the RCA office nearest you.

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